Gas Journal

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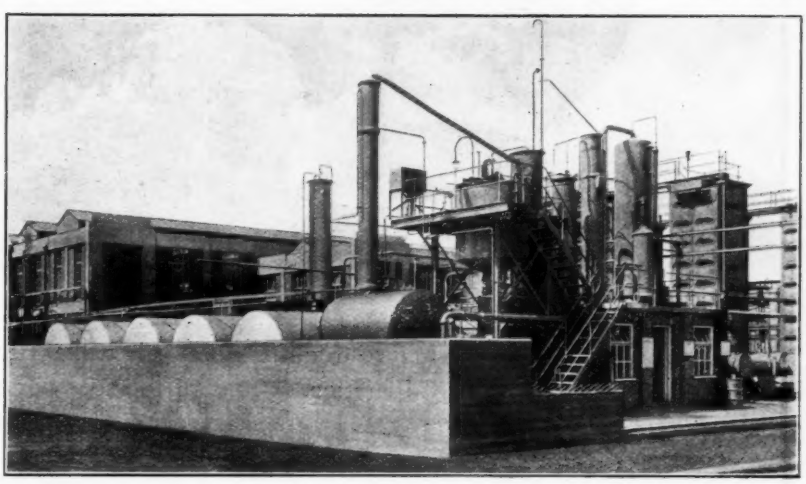

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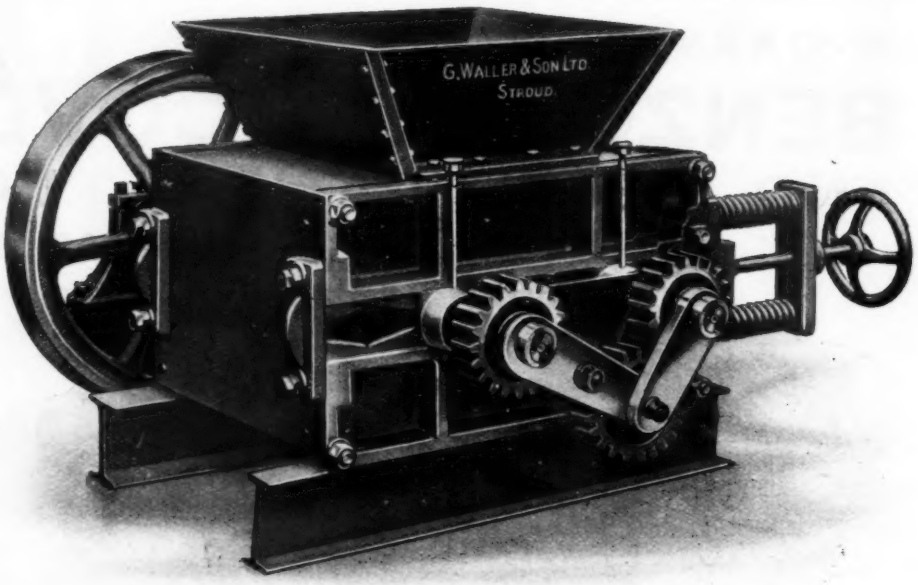

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CONTENTS

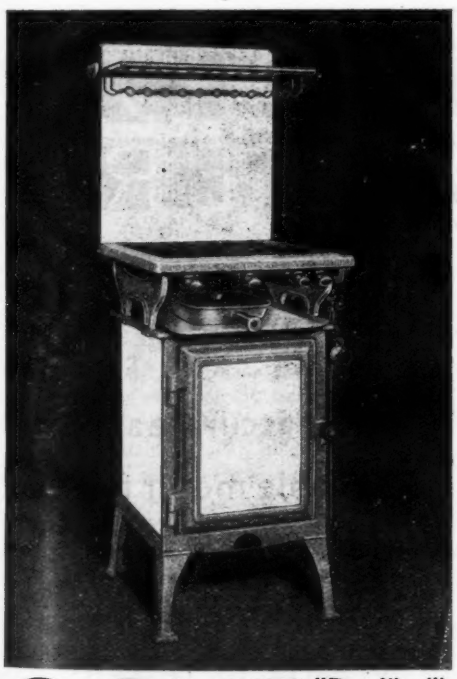
EDITORIAL NOTES.

Street Lighting 689
A Fundamental Requirement 689
Bold Policy Pays 690
Customer Service at Whitby 690
Price Down—Sales Up 690
Coal 691

Personal 692
Obituary 692
The Work of the Sanitary Engineer . . . 692
Forthcoming Engagements 692
The Royal Wedding and the Institution Research Meeting 692
News in Brief 693–94
A Souvenir Programme—The B.C.G.A. Conference at Edinburgh 694
Cheaper Gas at Edinburgh 694
Amalgamation and Grouping—
Sheffield and Barnsley 694
Good Work at Swindon 694
The Gibbons "H.T. 1" Refractory Bricks . 694
All Gas Kitchen for Glasgow Firm 695
New Showrooms and Offices at Exeter . . 695
The Coke Oven Managers' Association . . 695
Lanarkshire Gas Undertaking Appeal . . 695
Canada Forges Ahead 695
M.A.N. Waterless Gasholder Inaugurated at Middleton 696
New Showrooms at St. Austell Opened by Sir Francis Goodenough, C.B.E. . . . 697
A New Industry on Tyneside 698
Andover's New Gasholder 699
Wales and Monmouthshire Association of Gas Engineers and Managers—
Autumn General Meeting at Porthcawl . 700
Luncheon 701
Golf Competitions 702
North of England Gas Managers' Association—
The Association Luncheon 702
Business Meeting 703
Presidential Address of W. M. Galleway . 705
The Flash System of Carburetting. By Theodore Nagel 704
Specification for Portable Photometers . . 711
Association of Public Lighting Engineers—
Some Notes on Street Lighting Problems and Directional Gas Lighting. By Dean Chandler and A. J. Prestage 712
An Analysis of Modern Views on Street Lighting and their Relation to Visibility. By F. C. Smith, F.C.S., and K. F. Sawyer, B.Sc. 719
Main's New Season's Gas Fire List . . . 718
Gas Markets and Manufactures—
Stock Market Report 726
Current Sales of Gas Products 726
Trade Notes 726
Contracts Advertised To-Day 726
Gas Undertakings' Results 726

Stock and Share List 727

For Advertisers' Index see End of "JOURNAL"—PAGE 733.



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Gas Journal

SEPTEMBER 25, 1935

Vol. 211. 87th Year No. 3775

Editorial Notes

Street Lighting

On occasion of late we have queried whether the representation of gas is adequate in the Association of Public Lighting Engineers and also in the Illuminating Engineering Society, and we believe we have served a useful purpose in urging members of the Gas Industry—and, after all, gas is responsible for 70% of the lighting of our streets—to give their active support to these bodies. In our columns only a few weeks ago, referring to the meeting of the A.P.L.E., we said: " Our electrical friends are certainly alive to the value of membership of the national organizations dealing with the subject of lighting, and make excellent use of the platforms which these organizations provide. There was a danger that the very force of electrical numbers, and the lack of interest shown by gas engineers, would in this connection transfer gas from the stalls to the pit—or even to the gallery exit." There is not so much danger of this now, as exemplified by the gas representation at the A.P.L.E. meeting just past, which was presided over by a " gas " President, Mr. A. M. Bell, of the Tottenham and District Gas Company, and at which two of the communications—one by Messrs. Chandler and Prestage, the other by Messrs. Smith and Sawyer—showed that the Industry is not being idle in the matter of improving the standard of street lighting generally. We go so far as to say that a few years ago the Gas Industry could not have advanced Papers of such merit on the subject, and that the public generally, as well as illuminating engineering (and incidentally the Gas Industry), is bound to benefit from them.

That experts differ on the question of specifying the requirements of good lighting goes without saying. Satisfactory lighting for safety, however—as we have insisted—can only be planned by a thorough knowledge of the local conditions. " This knowledge," we said recently, " can best be obtained from a competent representative of the local authority concerned, who will co-operate with expert lighting engineers to ensure that the danger spots are well illuminated. The planning of a street lighting installation cannot follow the hard-and-fast rules of the drawing board." Both the Papers we have mentioned point to the fact that the appraisement of a street lighting installation solely in terms of measurements made by stationary observers upon stationary test objects may not represent the actual working conditions. Such measurements do not take into account the kinetic aspect and its effect upon the physiological and psychological response of the road users. What form of street lighting ensures the greatest degree of safety in a street peopled by living pedestrians, living drivers, living cats and dogs? This is the problem which awaits solution. For visibility the background as well as the road must be considered, and under practical conditions the background viewed is always changing. Hence the lighting of a given background without regard to the requirements of other equally important backgrounds may prove disastrous. Again, the lighting engineer is called upon to deal with many types of road surface, and, moreover, the condition of any given surface is not constant. Weather, usage, and age contribute to the uncertain condition of the surface. And in this regard Messrs. Smith and Sawyer refer to the deductions that are sometimes made as to the merits of a street lighting installation from photographs taken under static and uncontrolled conditions. The photographs they include in their Paper, taken, developed, and printed under precisely similar conditions, but with different times of exposure, show how misleading such deductions may well be. Photographs do not give a correct impression of what is seen unless they are taken under scientifically controlled conditions, since the chemical effect of light upon the emulsion is cumulative, whereas, once eye adaptation has occurred, no such cumulative effect is experienced by the eye. Incidentally the authors indicate how easy it is to fake a print by shading the negative during the printing process.

A Fundamental Requirement

However, we are forced to the broad conclusion that the first essential requirement for satisfactory road illumination is the provision of sufficient luminous flux per unit area of road. " Parsimony in this matter," state Messrs. Chandler and Prestage, " is false economy and can only lead to disappointment in the matter of satisfactory street lighting." On this question the view of the President of the A.P.L.E.—and we commented on this in last week's " Journal "—is that the cost of public lighting should be met out of a common fund, to which local and county authorities should contribute, and which should be aided by a generous contribution from the Road Fund. Of course, distribution of the luminous energy plays an important part; and in this connection a considerable part of the Paper by Messrs. Chandler and Prestage is concerned with a description of the new " Supervia " lamp developed by the South Metropolitan Gas Company, and with its performance. This lamp, it will be recalled, employs a mantle of rectangular shape—the maximum area facing up and down the road, where the light is required—together with a refractor dish. To what extent the new lamps have effected a marked improvement in the uniformity of the illumination is clearly depicted in the Paper; and delegates to the A.P.L.E. Conference were greatly impressed by the remarkably good illumination given by an installation of these " Supervia " lamps in Blackfriars Road, which formed

part of the tour of inspection of "The Lights of London."

Messrs. Smith and Sawyer take a very balanced view of the Street Lighting Specification of the British Standards Institution, which has, particularly of late, been subject to so much ill-informed and also well-informed criticism. Some say that the Specification is too complicated, but it seems to us that a simpler specification would be more open to question. It has to be borne in mind that the Specification is useful as a basis for tender, and it not only recognizes the importance of good design on agreed principles, but ensures, if applied, that lighting installations shall remain efficient. Another criticism mentioned by the authors is that it is possible for two or more installations to comply with the requirements for a given class, and yet differ widely in many respects from each other. But, within limits, Messrs. Smith and Sawyer do not agree that this is of necessity undesirable. "A lighting code," they say, "may be so general as to become valueless and allow very inferior installations to comply with the requirements; on the other hand, a code may be so specific that an installation judged to be of equal merit to another may be ruled out simply because the code is so specific. We believe the B.S.I. Specification, while permitting of different types of installation, satisfying the requirements, is in general sufficiently specific as to rule out installations which are obviously inferior as judged by present-day standards."

Bold Policy Pays

At Whitby Mr. Galleway has certainly had many "ups and downs" with his holders, and not a few peculiar difficulties to face in regard to works plant and also his distribution system, as he explains in his N. of E. Presidential Address; it is to his credit that he has surmounted the obstacles so successfully. On a restricted site his works to-day are in a very much better state than when he assumed control; and both works plant and the distribution system are in a condition compatible with the giving of first-rate modern gas service to the consumer. Moreover, the bold policy pursued over and over again in critical periods by the Whitby Gas Company has more than justified itself. The gas Mr. Galleway sends out is a half-and-half mixture of coal gas (made in horizontals) and Tully gas. The President has had long experience of the operation of Tully plant. Erected in 1920, a hand-operated plant worked for ten years, after which it was superseded by a mechanically-operated unit—a plant which, in Mr. Galleway's words, "has worked with great success."

Owing to the excessive charge for carriage it does not pay at Whitby to use anything but the best washed double or single nuts. The result is a first-class domestic smokeless solid fuel accompanying gas manufacture. Readers know our views on the preparation and marketing of coke, and it is a pleasure to note the analysis of the coke made at Whitby and the remarks of Mr. Galleway to the effect that attention to the making of a satisfactory coke is amply repaid. Whitby "gas coke" contains approximately 6% of ash, about 3·5% of moisture, and 6% of volatile matter, which is above the average; and since the installation of a coke breaker sales have been most satisfactory in face of severe competition from broken coke from coke ovens.

Mr. Galleway's story of how he has treated engineering problems on both works and district makes most interesting reading, but we are glad that he did not confine his attention to this aspect of the work of one in control of a gas undertaking. On the all-important question of sales and service there is similarity in many respects between the practice at Whitby and the suggestions on sales promotion put forward by Mr. Thomas Carmichael, of Portsmouth, in the "JOURNAL" last week. For example, Mr. Carmichael quite rightly insists that no undertaking can afford to be without an attractive showroom. For many reasons the old showrooms and offices of the Whitby Gas Company were unsuitable, among these reasons being the interest in the Company's activities displayed by several sheep, a bullock, and a steam roller. It was the visit of the steam roller which brought about the decision to acquire more appropriate premises. At the time this decision was made it was thought that the sale of apparatus had almost reached saturation point, but removal to the new showrooms put quite a different complexion on this view. The manner in which it has stimulated sales has in Mr. Galleway's view been "remarkable," but we are not at all surprised. Showroom enterprise leads one to expect a rapid rise in the curve of appliance sales.

Attractive showrooms, efficiently staffed, constitute however, only one aspect of sales promotion. Forceful advertising plays an important rôle, and here again Mr. Galleway's practice tallies with Mr. Carmichael's insistence that national propaganda must be backed up by effective local advertising. The Whitby Gas Company gives full and "free" maintenance for all classes of gas appliance sold—"service after sales;" and, to bring additional keenness into selling, commission is allowed to fitters on all sales effected by them. Local plumbers, too, are allowed commission on all sales they effect. Then, in regard to the black cooker, the Company's policy for some years has been to re-purchase out-of-date apparatus at a liberal price in part payment of modern appliances, and the Undertaking has recently introduced a scheme whereby black cookers on rental are being replaced with enamelled ones at a reasonable rental.

The foregoing steps taken by the Whitby Gas Company are, it will be agreed, highly satisfactory. Not so satisfactory, however, is the position when we turn to sales per consumer—and it must be said at once that Whitby is not alone in this respect. In 1906, with 1,840 consumers, the output was 43 million cu.ft. In 1934, with 3,686 consumers, the output was 67 million cu.ft. In other words, the average consumption per consumer has in this period fallen from approximately 23,100 cu.ft. per annum to 18,100 cu.ft. Which points to the urgency of leaving no stone unturned to check this decline. For many years Mr. Galleway has had in operation a progressive scale of discounts which became effective after the consumption of 25,000 cu.ft. per quarter. Thus, a consumer had to use 100,000 cu.ft. a year before he could benefit by the discount—which appears a very large figure when we consider the average consumption of 23,100 cu.ft. Recently the discount scale has been revised and considerably increased. Even now, however, no benefit is to be gained by consumers who do not use more than 40,000 cu.ft. a year—and this with an average consumption figure not half as much. It would be interesting to learn what percentage of the consumers in Whitby is affected by the discount concessions. Here would seem to lie a situation for the further application of the policy of boldness of which the Whitby Gas Company has reason to be proud.

Price Down—Sales Up

Nothing succeeds like success, and it is interesting to watch the progress made by those gas undertakings which have once "taken the plunge" by adopting attractive rates which on paper at any rate had an element of risk. The Newcastle-upon-Tyne and Gateshead Gas Company has taken many a plunge, of course, in rate structures—and to its great advantage. But in regard to domestic tariffs, in addition to the two-part,

the Company put into operation during the last Quarter of 1934 (see "JOURNAL" for Oct. 3 of that year) a block system in which the sizes of the blocks are based on the number of specified "assessable rooms" and also according to the season. Inspired by the success of this tariff the Company has gone a step further—and it is a very big step indeed.

The basic idea behind the new tariff, which was set out in last week's "JOURNAL," is simply that, if gas is to compete with, and oust, coal and oil—particularly, of course, coal in the domestic fire and kitchen range—it must be sold at such a price that all-gas service in a house does not cost the consumer more than part gas, part solid fuel arrangement. Now, the Newcastle Company is not given to miscalculation in matters of this kind, and with their latest price list we believe they are quite happy about being able to satisfy this condition. And the point worth emphasizing is that the raw coal with which they are competing is Newcastle coal *in* Newcastle, while household coal in some other parts of the country sells at as much as two-and-a-half times the price. It is equally true, of course, that others have to pay more for their gas coal supplies than Newcastle, but, as we see it, Newcastle competition with raw domestic coal is an extreme case, and others need not despair even if they cannot go as low as 3·06d. for gas.

It is not a bit of use expecting consumers to go "all gas" at a flat-rate price of 8d., 7d., or 6d. per therm. The appeal of cleanliness, comfort, and convenience does, of course, mean a great deal, but in many cases consumers cannot afford to pay a good deal extra for such service and have perforce, however reductantly, to put up with the inferior service provided by coal. With the new tariff in Newcastle, however, consumers need have no hesitation in adopting gas for all purposes in the home. After a comparatively small consumption users can, under the new scale, have additional gas at 3·06d. per therm; and no one is going to tell us that business in great volume is not to be gained by the Gas Industry at this price. The space heating and the water heating loads are ours at such a figure. We know that already a considerable proportion of the Newcastle ordinary consumers are in a position directly to benefit by being supplied by gas at 3d. a therm, and their experience of an all-gas service will quickly bring others into line.

As mentioned in the "JOURNAL" last week, the new rates have been launched by a publicity scheme on the customary Newcastle scale, and simultaneously with their publication, advertisements and editorial references appeared in seven different newspapers. In one day alone, 55,000 card folders were posted to the consumers. These were backed up by 250 posters, slides at 55 cinemas, window displays, poster stamps on correspondence, and by special letters to excess block users, to be followed up by personal calls by the sales representatives of the Newcastle Company. Which appears to us as just the way to tackle the tariff problem and gain business. Of the satisfactory results of this new move we have no doubt.

Coal

ONCE again coal mining looms up large, and perhaps menacingly, on the industrial horizon, and signs of intensive propaganda for improved standards of living and higher wages are apparent in many directions. Apart from the coal industry being a matter which affects us all nationally, it is no business of the Gas Industry to attempt interference in the domestic affairs of others. Nationally we all deplore lack of prosperity in the coal trade, and continue to hope that it will one day return, with fair reward to both colliery owners and miners. At the present juncture we hear of pits lying idle, in Durham for instance, for several days a week owing to lack of trade, and simultaneously of a demand by the miners for an all-round increase of two shillings a shift, and our hopes are driven almost to the point of despair.

In the meantime our immediate care as an Industry is to obtain regular supplies of good coal at a fair price —fair, that is to say, to those who produce it, and to ourselves *vis à vis* other industries with which we have to compete in service to the public—a great public utility. The question of coal prices generally, and particularly of the supplies to public utility undertakings, has for months past been very much to the forefront. The tone of the arguments advanced by the coal trade can be gauged from the address of Mr. R. A. Burrows, Deputy Chairman of Lancashire Associated Collieries, at the luncheon of the Coal Industry Society, a report of which appeared in our columns last week. Referring to public utilities, he suggested that they enjoyed what was practically a monopoly except for the competition between gas and electricity, which "probably was very severe," but they could not expect to take away from the coal industry the house coal market and supply gas and electricity in its place, and then buy coal at less than the cost of production. As to the competition between gas and electricity, we can assure Mr. Burrows that there is no probability about the severity of competition. Regarding the coal industry's central selling scheme, Mr. Burrows said that the only real opposition in Parliament had been from the public utilities, but he was inclined to feel that this was all due to a misunderstanding. He was sure that when they realized the facts of the coal industry they would wish to help rather than hinder.

As one of the coal industry's best customers, the Gas Industry has no wish to purchase coal below the cost of production; and we may be pardoned for suggesting that, in what is no longer a free market, it is not doing so. Moreover, bearing in mind what it costs to mine a ton of coal, it may be pardoned also for regarding with a certain questioning the great difference in cost at which electricity undertakings can buy coal as compared with gas undertakings. As for helping rather than hindering the coal trade, the Gas Industry's attitude has been expressed by Colonel W. M. Carr, President of The Institution of Gas Engineers. It is simply that, on a proved case, the Gas Industry is extremely anxious that the miner should be in a better position, and is willing to pay more for its coal provided there is no discrimination as between one user and another. It does not fear the hands of Government if applied impartially; it does strongly oppose discrimination. "The Gas Industry," said Colonel Carr, "would welcome a definite assurance that the miner would derive benefit from increased price, and that if the price of coal were advanced to public utility undertakings the coalowner should not be in a position to supply his own gas-works (the coke ovens) with coal at a very much lower price than that charged to gas undertakings generally. . . . One would feel happier if, on every one of the committees of investigation set up under the provisions of the Coal Mines Act, the public utilities were represented. The committees would be set up to decide whether the prices charged were fair and economic or whether the coal supplied was suitable for the requirements, and it was essential that the committees should be composed of people with the knowledge and ability to assess fairly the position as between the buyers and the sellers of coal. It was hoped that that matter would be adjusted, and that any increase of price which the Gas Industry had to find would not be applied to the reduction of the price of household coal or to reducing the already too low price at which coal was supplied to the coke-ovens."

Surely this is a legitimate attitude which ought to meet with full acceptance by the coal industry.

Personal

Mr. R. B. HODGSON, Managing Director of the Whessoe Foundry and Engineering Company, Ltd., Darlington, for 10 years and formerly Works Manager and Director of Messrs. Ashmore, Benson, Pease, & Co., Ltd., Gas Plant Manufacturers, of Stockton, is resigning from the post with the former firm at the end of this month. He will, however, continue to live in Darlington and hold a seat on the Board of Directors. Mr. Hodgson became associated with the Workington Bridge and Boiler Company, and joined Messrs. Ashmore, Benson, Pease in 1917. In 1925 he left the firm to take up his present post with the Whessoe Foundry. He is a member of The Institution of Gas Engineers, the Iron and Steel Institute, and the Institution of Mechanical Engineers. Business has caused Mr. Hodgson to travel extensively, and he has been instrumental in securing contracts in all parts of the world.

Mr. Hodgson will be succeeded by Mr. C. M. SPIELMAN, M.C., Assoc.M.Inst.C.E., who has been an active Director of the Whessoe Company for 12 years.

Obituary

The death is reported from Brussels at the age of 91 of M. ALEXANDRE TRIFFET, one of the pioneers of the Gas Industry in Belgium. The deceased was for many years associated with the Somzée firm and with the gas-works at La Louvière, Morlanwelz, Jemmapes, and Laeken. Later he took part in the setting up of gas-works in Leningrad, Rostov, Bordeaux, Blankenberghe, Dinant, and many other places.

The Work of the Sanitary Engineer*

In this comprehensive handbook, Mr. Arthur J. Martin, M.Inst.C.E., M.Inst.W.E., M.Cons.E., F.G.S., F.R.San.I., who is well known as an examiner of candidates for membership of the Institute of Sanitary Engineers and, also, under the late Sanitary Inspectors' Examination Board, of candidates for appointments as inspectors and health visitors, addresses himself to sanitary engineers, medical officers of health, sanitary inspectors, health visitors, every member of a local authority, and every young person who aspires to act in any of these capacities. And no one will doubt his excellent qualifications to do so; nor can anyone take seriously the statement, doubtless prompted by modesty and volunteered in the preface, that, on the practical side, he can lay claim "to no more experience than falls to the lot of many another engineer."

The work has been divided into six parts, the first of which deals with sanitary administration and includes chapters on legislation relevant to sanitation, local government, the various engineering societies and professional training associated with the profession, local expenditure, and public works. The multifarious aspects of water supply which devolve upon the sanitary engineer in the course of his duties form the subject of the next chapter. These include the law relating to the supply of water, chemistry and bacteriology of water, hydraulics and hydrostatics, purification and softening, and distribution. Drainage and sewage form the subject of the third part. Of interest to the gas engineer is the fourth part of the book which details the various trade wastes that have to be coped with in the disposal of sewage, and it is rather comforting to observe that so eminent an authority as the author devotes no more, if not less, attention to gas liquor than to the other waste liquids, although he is careful to mention that it is the most intractable of trade wastes which find their way into sewers. The law with regard to the discharge of trade wastes is lucidly explained and it would seem from this work that Mr. Martin is very well informed on legal matters.

The remaining sections deal with the collection and disposal of refuse and flood prevention, land drainage, and coast protection, both as regards technical and practical procedure. A perusal of "The Work of the Sanitary Engineer" cannot fail to leave one with the predominant impression that the author is a true master of his subject for he has covered the dry unsympathetic bones of theory with colourful references to bye-gone days and useful observations on modern practice supplemented by eighty-one informative illustrations.

* MacDonald & Evans, 8, John Street, Bedford Row, W.C. 1. Price, 16s. net. Demy 8vo, 488 pp.

Forthcoming Engagements

Sept.

26.—I.G.E.—Joint Lighting Committee, 2.30 p.m.
27.—I.G.E.—Liquor Effluents and Ammonia Committee, 11.15 a.m.; Joint Research Committee, 2.30 p.m.
28-Oct. 1.—B.C.G.A.—Annual General Meeting and Conference at Edinburgh.

Oct.

3.—MIDLAND JUNIOR ASSOCIATION.—Presidential Address of F. L. Atkin.
4.—I.G.E.—Research Executive Committee, 2.30 p.m.
5.—MANCHESTER AND DISTRICT JUNIOR ASSOCIATION.—Meeting at Preston. Presidential Address of Mr. A. K. Collinge.
5.—SCOTTISH EASTERN JUNIOR ASSOCIATION.—Presidential Address of Mr. A. J. Doran.
7.—I.G.E.—Finance Committee, 1.45 p.m.; Membership Committee, 1.45 p.m.; General Purposes Committee, 3.15 p.m.; Benevolent Fund Committee of Management, 4.30 p.m.
8.—I.G.E.—Council, 10 a.m.; Gas Education Committee, 4 p.m.
9.—I.G.E.—Gas Education Executive Committee, 10 a.m.; Council, the British Gas Federation, 10.30 a.m.; Board of Examiners, 2.30 p.m.
16.—B.C.G.A.—Executive Committee, 11 a.m.
17.—B.C.G.A.—Midlands District Conference at Wolverhampton.
17.—EASTERN COUNTIES ASSOCIATION.—Autumn Meeting at the Stanton Ironworks Company, near Nottingham.
17.—SOUTHERN ASSOCIATION (EASTERN DISTRICT).—Meeting at 28, Grosvenor Gardens, S.W. 1.
18.—MANCHESTER DISTRICT ASSOCIATION.—Meeting at Midland Hotel, Manchester, at 2.30 p.m.
18.—LONDON AND SOUTHERN JUNIOR ASSOCIATION.—Presidential Address of J. M. Webber.
19.—SCOTTISH JUNIOR ASSOCIATION.—Joint Visit to Thomas Glover & Co., Ltd., Edmonton.
26.—WESTERN JUNIOR GAS ASSOCIATION.—Meeting at Bristol.
29.—B.C.G.A.—Eastern District Conference at Peterborough.

Nov.

4.—B.G.F.—1st Annual General Meeting, Grosvenor House, Park Lane, London, W. 1, 3 p.m.; 2nd Annual Dinner, Grosvenor House, Park Lane, London, W. 1, 7 p.m.
5.—I.G.E.—Council, 9.30 a.m.; Council, 4.30 p.m.
5 and 6.—I.G.E.—7th Autumn Research Meeting at The Institution of Mechanical Engineers, Storey's Gate, St. James' Park, S.W. 1.
6.—MANCHESTER AND DISTRICT JUNIOR ASSOCIATION.—Visit to Prescot. Paper by Mr. F. N. Booth and Mr. J. Fletcher.
7.—MIDLAND JUNIOR ASSOCIATION.—Meeting. Paper by Mr. R. G. Marsh.
12.—I.G.E.—Gas Education Executive Committee, 4 p.m.
14.—MIDLAND ASSOCIATION.—Autumn General Meeting. Grand Hotel, Birmingham.
14.—SOUTHERN ASSOCIATION (EASTERN DISTRICT).—Meeting at 28, Grosvenor Gardens, S.W. 1.
15.—LONDON AND SOUTHERN JUNIOR ASSOCIATION.—Annual Dinner.
19.—I.G.E.—Session at the 8th Public Works, Roads and Transport Congress and Exhibition, Royal Agricultural Hall, London, N. 1, 3 p.m.
22.—LONDON AND SOUTHERN JUNIOR ASSOCIATION.—Meeting.
29.—I.G.E.—Liquor Effluents and Ammonia Committee, 11.15 a.m.; Joint Research Committee, 2.30 p.m.

The Royal Wedding and the Institution Research Meeting

In view of the Royal Wedding on Wednesday, Nov. 6, 1935, those attending the Annual Dinner of the British Gas Federation on Monday, Nov. 4, and the Autumn Research Meeting of The Institution of Gas Engineers on Tuesday and Wednesday, Nov. 5 and 6, are advised by the Secretary of the Institution to reserve hotel accommodation without delay.

News in Brief

Volume XVI. of the Proceedings of the Chemical Engineering Group of the Society of Chemical Industry has been kindly forwarded to us by the publishers.

The Travelling Showroom of Messrs. R. & A. Main, Ltd., is to visit the area of the Lockerbie Gas Company, and will be situated at the Gas-Works from Oct. 1 to 4.

During the Recent Celebrations of the jubilee of Coatbridge as a Burgh, the Provost's house, two schools, the Fountain, and the War Memorial were all floodlighted with gas.

An Official Return issued in Dublin shows that the amount of money collected by way of tariffs on gas heaters and kindred goods entering the Free State for the financial year 1934-35 totalled £280.

Applications are Invited for the position of Assistant Engineer to the Exeter Gas Light and Coke Company. The commencing salary will be £500, and applications must be received by Oct. 12 next.

An All-Gas Show House was opened on Sept. 18, in Smithy Lane, Wrexham, where the Wrexham Gas Company is to demonstrate the advantages of gas for lighting, heating, cooking, and washing.

The Opening Meeting of the Illuminating Engineering Society will be held at the Lighting Service Bureau, 2, Savoy Hill, Strand, W.C. 2, by kind permission of the E.L.M.A., on Oct. 8 at 4.30 p.m.

13,000 Free Sites—a record number—have been offered by foreign and Empire countries for the display of the poster for next year's British Industries Fair which opens in London and Birmingham on Feb. 17.

Application is Intended to be made to the Board of Trade under the Gas Undertakings Acts, 1920 to 1934, by the Leeds Corporation for the purpose among others of extending the limits within which they are entitled to supply gas.

A Copy of the Proceedings of the Victorian Centenary Gas Congress held under the authority of representative gas companies in Victoria (Australia) on Oct. 30, 31, and Nov. 1, 1934, has been kindly forwarded to us by the Gas Companies' Association of Australia.

A Finely Decorated Motor Vehicle belonging to Blackburn Corporation Gas Department won a silver cup at the annual motor parade at Blackburn on Sept. 21. The trophies were presented by Mr. W. Chamberlain, Chairman of Commissioners for North-Western Traffic Area.

Permission to Install Gas Cookers and emergency points in the first housing scheme buildings has been granted by the St. Monance Town Council to the local Gas Undertaking. The arrangements for the cookers are to be made between the tenants and the Gas Company.

A Special Order is intended to be applied for to the Board of Trade under the Gas Undertakings Acts, 1920 to 1934, by the Darlington Corporation with the object *inter alia* of empowering them to enter into an agreement with Messrs. Strakers & Love, Ltd., for a supply of gas in bulk from the Brancepeth Colliery.

The Possibilities of a Gas Grid for Lanarkshire and Renfrewshire are to be investigated by a committee set up by the Board of Trade containing several well-known West of Scotland business men. The scheme, it will be recalled, was first suggested to Sir Arthur Rose, Commissioner for the Special Areas, by the Lord Provost of Glasgow, Sir A. B. Swan, and Treasurer Dollan, of the same City.

The Severn Valley Gas Corporation announce that the semi-annual dividend at the rate of 4½% per annum on the 4½% cumulative preference shares, and an interim dividend at the rate of 5% per annum on the issued ordinary shares of the Corporation for the period for which they rank for dividend, will be paid on Oct. 1, 1935. Both dividends are in respect of the period April 1 to Sept. 30, 1935.

Outputs are Increasing in Norway, according to a return recently issued by the Norwegian Gas-Works Association. The total production of fifteen works during the financial year 1934-35 reached a total of over 1,365 million cu.ft. against 1,359 million cu.ft. in 1933-34. This is a very satisfactory state of affairs, for there exists in Norway an abundant supply of water power which makes for cheap electricity. Only four of the Works have outputs in excess of 100 million cu.ft. The largest plant is at Bergen which produced 480 million cu.ft. last year—an increase of over two million cu.ft.

All-Gas Exhibition Houses find great favour among the citizens of Liverpool and yet another was opened on Sept. 19 in Broadgreen Road, Bowring Park. Switch controlled lighting, modern fires and radiators, and gas water heaters installed by the Liverpool Gas Company, as well as a gas refrigerator, combine to make the house all that is to be desired in the matter of convenience and labour saving.

A Reduction of 2d. per 1,000 cu.ft., or 0·42d. per therm, in the price of gas has been decided upon by the Elgin Council after consideration of the estimates for 1935-36. This now makes the price 2s. 10d. per 1,000 cu.ft., or 7·16d. per therm, for ordinary purposes and 2s. 4d. per 1,000 cu.ft., or 5·89d. per therm, for industrial purposes, all subject to 5% discount. The same prices apply to gas consumed through prepayment meters.

For Providing and Fixing a Lamp, free of cost, at Brooklands Hill, the Plymouth and Stonehouse Gas Company have earned the gratitude and goodwill of the people of St. Burdeaux, and this was publicly voiced at a recent meeting of the Parish Council when a vote of thanks to the Company was passed. This is only one instance of where the Company has gratuitously provided lamps for the public in the suburbs of Plymouth.

A Local Branch of the Women's Gas Council is being organized in Belfast by Miss E. L. Crawford, M.C.A., cooking demonstrator to the Belfast Corporation Gas Department. Great stimulus is being lent to the movement locally since the Marchioness of Londonderry is President of the W.G.C. Record attendances are the rule at the three months' series of demonstrations and lectures which Miss Crawford has just commenced at the Queen Street showrooms.

The Offer for Sale by Tender of not exceeding £40,000 4% irredeemable preference stock (minimum price of issue of £100%) is made by the Chester United Gas Company. Copies of the Prospectus and forms of tender can be obtained from the offices of the Company, Chester House, Northgate Street, Chester; from Lloyds Bank, Chester; or from Messrs. Sing, White, & Co., 26, Exchange Street East, Liverpool 2. The last day for the receipt of tenders is Oct. 4, 1935, at 11 a.m.

Opening a Gas Cooking Exhibition at Limerick recently, Alderman Casey, the Mayor of the city, revealed that the price of gas in Limerick had been reduced 25% during recent months while the demand for gas cookers had increased from 1,200 to 3,000 in a couple of years. Referring to by-products the Mayor said 3,000 tons of tar had been manufactured at the local works since that development was initiated and at present 600 tons were being supplied to Limerick County Council for road-making.

A 7-Years' Lighting Contract with the Selkirk Gas Company has been recommended by the Works Committee of the Selkirk Town Council. The offer of the Company to light the streets during the current season at a charge of 3s. 4d. per 1,000 cu.ft. has been accepted, and recommendation that a contract be entered into with the Company for the lighting of the street lamps for a period of 7 years providing for a discount of 20% on the price of gas, all the other terms and conditions already being continued.

A Victory for Gas was recorded in a recent issue of the *Greenock Telegraph* which reports that gas has been selected to light the streets of the new housing scheme at Gibbshill and Bogston after an open debate at the Local Council meeting. The Lighting Inspector stated that the cost of supplying and fitting 111 2-light gas lamps would be £703 and the annual maintenance cost £229, while the cost of supplying and erecting 112 100-Watt electric lamps would be £700 and the annual maintenance charge £288. The voting in favour of gas was 5 to 2.

No Fewer than Six Stands are occupied by the Rochdale Corporation Gas Department, in co-operation with a number of appliance manufacturers, at the Home, Health, and Fashion Exhibition now being held at the Drill Hall, Rochdale. The firms co-operating are: Messrs. John Wright & Co., Ltd. (Radiation, Ltd.); General Gas Appliances, Ltd., Manchester; W. H. Dean & Son, Ltd., Burnley; Falk, Stadelmann, & Co., Ltd., Manchester; Maxol Heaters, Ltd., Manchester; James Stott & Co. (Engineers), Ltd., Oldham; J. Brockhouse & Co., Ltd., Wednesbury; George Bray & Co., Ltd., Leeds; and Ewart & Son, London.

There was a Breakdown in Pontefract's electricity supply on Saturday night, states the *Yorkshire Post*, which lasted for about an hour. The streets were at their busiest, Saturday being market day. Cinema audiences had to wait nearly fifty minutes before they could see the finish of the principal film. There was a rush for candles by the shopkeepers. Fortunately for vehicular and pedestrian traffic, the streets of the town are lighted by gas, and multiple stores have an alternative gas supply.

Referring to the New Benzole Recovery Plant, to be installed at the Granton Gas-Works at a cost of £7,500, Councillor Walter Muter, at a meeting of Edinburgh Gas Sub-Committee on Sept. 20, said that the plant was of a relatively low cost and was going to give a high return. The Department at the moment was giving employment to 1,000 miners each year, and the extra plant would give employment to another fifty miners. It appeared, he said, that this country would have to rely more and more upon the home production of oil, and this was a step forward and a notable contribution. The estimated production of benzole by the new plant is 214,000 gallons per annum.

Freedom of Choice for tenants of council houses in respect of a medium for heating, lighting, and cooking is threatened at Wakefield where the Housing Committee have recently submitted to the City Council a resolution that all further municipal houses be equipped with all-electric appliances with the exception of provision for a gas boiling ring. It is further stipulated that any tenant preferring gas equipment shall install such at his own expense and shall store and replace the electrical appliances on termination of tenancy. At the September meeting an amendment was moved and seconded that freedom of choice should be given to Corporation tenants. The Council referred the whole matter back to the consideration of the General Purposes Committee, and already the opponents of the Housing Committee's scheme are preparing to fight it to the utmost. Gas is supplied at Wakefield by the Wakefield Gaslight Company, while the Corporation are responsible for the electrical supply from the "grid."

A Souvenir Programme

The B.C.G.A. Conference at Edinburgh

The official programme which has been prepared in connection with the forthcoming 24th National Conference of the British Commercial Gas Association at Edinburgh from Sept. 28 to Oct. 1 is a very fine production and will form a worthy souvenir of an important gathering.

Not only are full particulars of the various proceedings set out with the greatest clarity, but portraits are included of some of the speakers, in addition to an excellent frontispiece of the President, Councillor Walter Muter, together with his biographical notes.

Full attention is given to the programme of social events, and for those who are unfamiliar with the Scottish Capital, a large-scale plan of central Edinburgh indicates the whereabouts of the principal landmarks. The B.C.G.A. are to be congratulated upon so admirable a production.

Cheaper Gas at Edinburgh

A reduction in the price of gas which will amount to an annual saving to consumers of over £20,000 is proposed in Edinburgh. The reduction will bring the price to below pre-war rate and follows on a reduction made last November. A joint report on the subject was submitted on Sept. 20 by the City Chamberlain and the Engineer and Manager of the Gas Department, Mr. James Jamieson, to the Public Utilities Committee of Edinburgh Town Council.

At present the rate charged is 2s. 9d. per 1,000 cu.ft. for the first 10,000 cu.ft. per quarter, with reductions for consumption in excess of that amount. It is proposed, subject to the approval of the Council, that the rate after November should be: For the first 5,000 cu.ft. per quarter, 2s. 6d. per 1,000 cu.ft.; all over 5,000 up to 100,000 cu.ft., 2s. 3½d. per 1,000 cu.ft., with further reductions beyond that amount.

Prepayment meter consumers, who now pay at the rate of 3s. 1·62d. per 1,000 cu.ft., and did not benefit by the last reduction, will still pay 3s. 1·62d. per 1,000 cu.ft. for the first 5,000 cu.ft., but thereafter will pay at the same rate as ordinary consumers—namely, 2s. 3½d. or less as the case may be. The pre-war rate was 2s. 8d. per 1,000 cu.ft.

When the report, which was approved, was submitted at the Committee meeting, Councillor Walter Muter, Convener of the Gas Sub-Committee, said he hoped they would be in a position before another budget year was out to intimate a further substantial decrease in the charges affecting gas.

Amalgamation and Grouping

Sheffield and Barnsley.

The Sheffield Gas Company has offered to purchase the business of the Barnsley Gas Company. The offer provides for the payment of £160,000 as direct purchase money and includes certain other considerations in respect of the Barnsley Company's debenture stock.

The Barnsley Gas Company has an authorized and issued capital of £100,000 and a small amount outstanding of debenture stock. Issued capital of the Sheffield Gas Company is £1,736,000.

Good Work at Swindon

The whole of the Works of the Swindon United Gas Company has been completely remodelled during the past three years and a new carbonizing plant was brought into working on Aug. 2, 1935. It is of the intermittent vertical chamber oven type made by Messrs. W. J. Jenkins, of Retford, comprising 12 chambers each of 3¾ tons capacity, and incorporates complete coal and coke handling plant, together with a reinforced concrete coke bunker having a capacity of 200 tons with a screening plant superimposed.

The old lay-out of the plant prevented any extensions and the new plant was so designed as to allow for all possible extensions on the present site and to give economical coal and coke handling.

It is of interest to note that the output of gas during the past three years has been increased by no less than 32% and the rate of increase is growing—*e.g.*, the increase in the first half-year of this year was 9·06% compared with that of 1934. While for the past two months of this half-year it is 18·7%, due largely to the development of industrial loads and rural areas. The increase does not include the output obtained by purchasing small Undertakings in the neighbourhood—namely, Marlborough, Faringdon, Fairford, Wootton Bassett, and Highworth, which in themselves are showing increases between 30% and 50% within 12 months of the taking over. This is due to extensive canvassing and the adoption of hire-purchase policies and better service.

The Gibbons "H.T. 1" Refractory Bricks

The advantage incurred by the use of refractory insulation is now universally acknowledged, and, in presenting their "H.T.1" refractory brick, Messrs. Gibbons (Dudley), Ltd., point out that the material has been evolved after years of research work, and has been thoroughly tried out in practice.

The "H.T.1" brick may be used to advantage in practically every type of heating plant from the smallest heat treatment furnace to a coke oven. The brick is of highly refractory material which is claimed to possess six times the heat insulation properties of ordinary firebrick. Its use either as a backing to the normal inner refractory wall, or, as is possible in many cases, to form the inner lining, makes possible a thinner and lighter construction generally. By reason of the low thermal capacity of such a construction, and the heat-resisting properties of "H.T.1" bricks, very considerable economies in fuel are effected. A further advantage claimed for the material is that where plant is operated intermittently the much increased rate at which temperature can be raised results again in fuel economies.

Thermal conductivity tests resulted as follows:

Hot Face. Temp. °C.	Cooler Face. Temp. °C.	Mean Temp. °C.	Mean Temp. °F.	Conductivity. C.G.S. (*a*).	Conductivity. British Units (*b*).
526	109	318	604	0·00044	1·29
698	140	419	787	0·00051	1·47
810	164	487	909	0·00054	1·58
905	176	541	1,005	0·00056	1·64
1,019	200	610	1,130	0·00060	1·74
1,115	214	665	1,228	0·00063	1·83

(*a*) Gram-calories per sq.cm. per sec. for 1 cm. thickness and 1° C. difference in temperature.
(*b*) B.Th.U. per sq.ft. per hour for 1 in. thickness and 1° F. difference in temperature.

Shrinkage tests were carried out, and at 1,200° C. the dimensions of the brick were unaltered. At 1,350° C. the change in dimensions was negligible (maximum contraction 0·15%). The crushing strength (cold) is 350 lb. per sq.in. The strength of the material is not affected by water, and the brick may be drilled or ground without danger of crumbling.

All-Gas Kitchen for Glasgow Firm

"The kitchen is the most important room in the house. The life and the happiness of the household are founded on good cooking. And if the housewife is happy in her work the cooking is sure to be good."

With these remarks Glasgow's Lady Provost on Sept. 4 declared open the wonder gas kitchen in the warehouse of Messrs. Wylie Hill & Co., Buchanan Street, Glasgow. Hundreds of women flocked to the first view of this delightful green and chromium kitchen, where all the fitments are operated by gas. "As Vice-President of the Glasgow Branch of the Electrical Association for Women, I am on rather dangerous ground," said Lady Swan, "but I think that electricity and gas should be, not competitors, but co-operators in the kitchen. If you use more gas, the Gas Department will supply it more cheaply—and in the last three years the Department has decreased the price by 15% from 3s. 6d. to 3s."

The kitchen, which has been designed by Messrs. Wylie Hill, in conjunction with the Corporation Gas Department, is intended to show labour-saving gas equipment in its appropriate setting. The cooker is in green marble, and a gas incinerator, rather a novelty in a Scottish kitchen, deals with the refuse problem in the quickest, cleanest, and most simple way. Another very useful fitment in this ideal kitchen is a drying room, opening out from either scullery or kitchen, where the temperature is regulated, and cannot rise above 120° F. The kitchen also includes a gas-operated refrigerator and boilers supplying hot water at a moment's notice.

New Showrooms and Offices at Exeter

The Exeter Gaslight and Coke Company is nothing if not enterprising. For some time past it had been recognized that the existing showrooms and offices in Southernhay East hampered the activities of the concern, and it was resolved that nothing short of complete reconstruction of those premises, and the addition of new accommodation, would suffice to remedy this, permit of the press of business being despatched with greater efficiency, and, at the same time, provide the Company with quarters designed on the most up-to-date lines.

No pains have been spared to ensure that the new façade harmonizes with the features of the neighbourhood. Spacious display windows flank the main entrance on either side, and the ground floor showrooms and offices have been arranged on elaborate lines designed to be at once attractive and effective both from the point of view of business and the comfort and convenience of the Company's clientele. The department set apart for cookery demonstrations has been planned to give all attending such lectures every opportunity of seeing and hearing all that is going forward. It has also the latest system of ventilation, which serves to keep the various parts of the building at a comfortable heat in winter, and introduces cooled clean air in summer.

On Sept. 18, there was an official inspection of the new showrooms and offices, at which the Chairman (Mr. John E. Daw, J.P.), and the Directors of the Company received a large company representative of civic and business life in the city and county. Previously, the Chairman and Directors had given a private luncheon at the Rougemont Hotel to a number of guests among whom were the Mayor of Exeter (Mr. J. W. Ackroyd), the Sheriff (Mr. W. W. Beer), the Town Clerk (Mr. C. J. Newman), Mr. A. C. Reed, M.P., Sir James Owen, J.P., Mr. Kenneth Gatey, M.C., Mr. R. Arthur Daw, Mr. G. C. Daw, Mr. H. Austen Hall, F.R.I.B.A., Mr. W. N. Westlake, Engineer and General Manager, and Mr. E. H. Dart, Secretary.

Welcoming the visitors, Mr. Daw recalled that Exeter was one of the pioneers of the Gas Industry, the first statutory meeting being held on May 9, 1816. The business of the Company had risen from an annual sale of 14¼ million cu.ft. in 1839 to 220 million cu.ft. in 1898 and was rapidly increasing. By 1934 sales of gas had risen to 737 million cu.ft., or three and a third times the 1898 total, and their premises were quite inadequate to deal with the growth of business entailed. After prolonged consideration the Company decided that nothing less than a complete reconstruction of buildings could meet their needs. Reconstruction of an old building entailed great difficulties, and they could congratulate themselves and, he hoped the city, in having been fortunate enough to secure the services of Mr. Austen Hall, whose design when put before them was proof that they could obtain all the accommodation wanted within the boundary of their own property and produce a building providing all modern requirements and still be in keeping with the character of the premises around it and be at once useful and dignified.

"I see no reason to doubt that our prosperity of the past will be continued in the future," added Mr. Daw. "The price of gas in Exeter and the district is low, particularly if you bear in mind our geographical position with regard to the coalfields." To Mr. Westlake and the staff at Southernhay and to all employees at the Works their indebtedness was great for their devotion to the Company. The Chairman, expressing appreciation of the presence of those connected with the civic and county administration, said it was another link in the chain of their long association with Exeter.

The Mayor, thanking the Chairman and Directors on behalf of the visitors, recalled that the city and the Company had been linked up in a variety of ways for nearly 120 years.

Prior to the opening ceremony, an extensive inspection was made of the premises, general appreciation being expressed of the handsome improvements effected. Refreshments were provided, and a programme of light music was rendered by the orchestra of the Theatre Royal, arranged by Mr. Sidney Stowell.

The architects for the undertaking were Mr. H. Austen Hall and Messrs. Dobell & Ballardie, and the builders, Messrs. Stephens & Son, Ltd., Exeter.

The Coke Oven Managers' Association

The annual dinner of the Coke Oven Managers' Association will take place at the Hotel Victoria, Northumberland Avenue, London, W.C. 2, on Thursday, Oct. 24, 1935.

The reception by the President at 6.45 p.m. will be followed by dinner at 7.15 p.m. prompt. Tickets for the dinner, for which an early application is requested, may be obtained from the Hon. Dinner Secretary, Mr. Charles H. Newby, Tankersley, Nr. Barnsley, Yorks. On the following day, through the courtesy of Prof. G. T. Morgan, of the Department of Scientific and Industrial Research, members and guests are invited to visit the Chemical Research Laboratory at Teddington, Middlesex. Motor coaches will leave the Hotel Victoria at 10.45 a.m., arriving at Teddington at 11.45 a.m. Lunch will be taken at 12 noon, and, at the conclusion of the visit, members and guests are invited to have tea with Prof. G. T. Morgan. Return motor coaches will reach the Hotel Victoria at 5 p.m. Transport to and from Teddington and lunch will be provided at an inclusive charge of 4s. 6d. per head.

Lanarkshire Gas Undertaking Appeal

At an adjourned meeting of Lanarkshire Valuation Court in Glasgow on Sept. 20, Lanarkshire County Council appealed for a 50% reduction of the assessment of £46,627 on the County Gas Undertakings.

Mr. Thomas Royden, Engineer and General Manager, said the County authorities had acquired various undertakings in 1920-21 at a cost of £537,158. Over-capitalization, trade depression, and competition from electricity and oil fuel, had made things difficult and since 1927 gas sales had dropped from 528 million cu.ft. to 408 million cu.ft., while the estimates for the present year showed a deficiency of £28,000, which was practically a third of their total revenue from gas sales. The Works were capable of making 3 million cu.ft. daily but the demand was only for 1,250,000 cu.ft.

Mr. George H. Shilton, Deputy County Treasurer, gave similar evidence and Mr. Walter Henderson, Deputy County Clerk, said the Undertaking would be unable to carry on unless some relief were given.

By a majority, the Court decided to lower the assessment by 33⅓%.

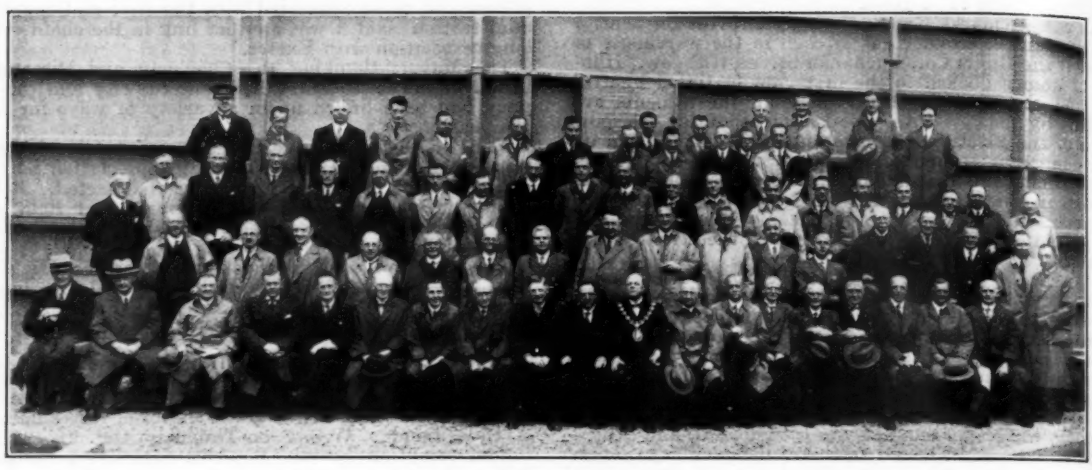
Canada Forges Ahead

We have received the following encouraging information from the Natural Resources and Industrial Information Bureau of the office of the High Commissioner of Canada: The Dominion Bureau of Statistics at Ottawa, in a report on the "Coke and Gas Industry in Canada, 1934," shows that forty-one Canadian coke and gas plants operating last year turned out products with a total value of $38,272,020, an increase of 28% as compared with the 1933 total for the Industry. The Industry is capitalized at $99,297,395 and employed 4,278 persons last year whose earnings amounted to $5,648,969.

The plants operated included 8 by-product plants, 2 beehive plants, 23 retort or carburetted water gas plants, and 8 plants for making pintsch oil gas for lighting railway cars. Twenty-one of these works were located in Ontario, 6 in British Columbia, 4 in Quebec, 3 in Manitoba, 2 in each of Nova Scotia, New Brunswick, and Alberta, and 1 in Saskatchewan.

The output of gas-house, by-product, and beehive coke in Canada during 1934 totalled 2,243,420 tons as compared with 1,772,164 tons in the next preceding year and 1,637,701 tons in 1932.

M.A.N. WATERLESS GASHOLDER



A group taken at the opening ceremony.

Inaugurated at Middleton

The inauguration of the M.A.N. Waterless Gasholder erected by Messrs. R. & J. Dempster, Ltd., for the Gas Committee of the Borough of Middleton, near Manchester, took place on Wednesday, Sept. 18, at the Middleton Gas-Works.

The site was a difficult one for gas storage purposes. It is bounded by cottages on rising ground, a river, large mill, and a public roadway. The nature of the ground required that any gasholder must be carried upon piles, and as Mr. H. D. Robinson, the Engineer, explained, a waterless type appeared to conform to their requirements.

The structure has been painted in three shades of blue grey, and presents a very handsome appearance. It is 87 ft. in diameter by 148 ft. 3 in. high to the eaves, having 14 sides, with a piston travel of 130 ft. 9 in. Safety seals are provided at the inlet and outlet pipes in order that it may be completely isolated, and this also permits free examination of the inlet and outlet valves.

Councillor H. Parkes (Chairman of the Gas Committee) opened the valve which turns the gas into the mains. He said that in 1911, when the Committee began to look round for a site for another holder, they had three gasholders with a total storage capacity of 685,000 cu.ft. The Lark Hill site was acquired in 1931 and they decided to adopt the M.A.N. waterless gasholder. It was essential for the public service of the town to have a good and cheap supply of gas, and they hoped this new holder, which added 750,000 cu.ft. storage capacity, would enable that to be provided during many years to come.

At a luncheon in the Assemby Hall, the guests of the Gas Committee numbered about 70. Councillor Parkes presided.

Mr. A. L. HOLTON, Chief Engineer, City of Manchester Gas Department, proposed the "Middleton Corporation Gas Department." He remarked that Middleton had several links with Manchester, many of whose citizens resided in the borough, especially on the rapidly developing Alkrington estate. In the brochure which had been supplied to the visitors the historical account of the Undertaking began with the remark that there was little romance attached to the history of gas making. Surely there were all the essentials of romance in the progress revealed by the records of the Middleton Gas Undertaking, made in times of trade depression and in spite of a disastrous flood and other difficulties. It was modestly stated that gas was sold to the public at prices which compared very favourably with those ruling in the largest cities and towns in the country. He would rather say such prices were envied by quite a number of the large undertakings. Progress led inevitably to the question of storage capacity, and the new holder would certainly ease the anxiety of the Engineer and the Staff at peak load periods, and would provide a margin for continued growth. He congratulated the Gas Committee on having entrusted the work to Messrs. R. & J. Dempster, Ltd. That firm had erected gasholders of all types and sizes all over the world, and they were in the forefront in the erection of the waterless type.

The CHAIRMAN said that in Middleton they felt they had an up-to-date works of which they could be proud. Their late Engineer, Mr. Rogerson, was well known throughout the Gas Industry, and his successor, Mr. Robinson, had carried out his duties faithfully and well and had the full confidence of the Chairman and the Committee. In any trading concern connected with the Corporation the consumers should get the benefit, and the Committee had not been ambitious of making a large profit. The main factor

Councillor H. Parkes (Chairman of the Middleton Gas Committee) opening the valve of the new holder. On the right is the Mayor (Councillor F. L. Kay, J.P.).

in their steady progress had been that they gave a good cheap supply with a very satisfactory service.

Councillor R. ALDERSON, the Vice-Chairman of the Gas Committee, gave the toast of "The Contractors." He said the Committee gave the contract to a firm who, they knew, would not endanger a high reputation. They had in fact enhanced it; every department had been carried on admirably, and there had not been any cause for anxiety from start to finish.

Mr. J. WINSON SCOTT (Director of Messrs. R. & J. Dempster, Ltd.) replied to the toast, and on behalf of the firm requested the Chairman to accept a silver salver as a souvenir.

The CHAIRMAN in expressing his acceptance stated that he had been in public service eleven years.

The MAYOR OF MIDDLETON, Councillor F. L. Kay, J.P., proposed the toast of "The Visitors." He mentioned that the history of Middleton went back to the eleventh century, but they were modern, up to date, and, he hoped, efficient.

Mr. C. F. DRINKWATER, J.P., C.C., Chairman of the Hyde Gas Company, remarked that visits of this kind had become an established feature in the Gas Industry. He was one of a deputation which made very careful enquiries into the progress which had been made with the waterless type of holder, and they appreciated the willingness and frankness with which information was given to them by gas engineers and managers.

Mr. A. F. AMES, Engineer and General Manager, Burnley Corporation Gas Department, said that for many purposes gas gave a better service than electricity, and could never be dispensed with. Heat could be obtained more quickly and controlled more easily and accurately than was possible with any other fuel. The rapid growth of its use for industrial purposes indicated its popularity in this field.

Mr. J. W. MCLUSKY (Engineer and General Manager, Glasgow Corporation Gas Department) said gas engineers appreciated that electricity had its uses, and they used it in their own Works; but it should not induce them to slacken their efforts in competition with electricity.

Alderman R. GRUNDY, J.P., a member of the Gas Committee for many years and described by the Chairman as the "Father of the Council," added a few words.

The CHAIRMAN proposed the toast of "Our Engineer" which was cordially honoured by the guests and was responded to by Mr. H. D. ROBINSON.

The Attractive Exterior of the New Premises.

New Showrooms

AT

St. Austell

The opening ceremony of the St. Austell Gas Company's new showrooms in Church Street, St. Austell, on Sept. 18, was performed by Sir Francis Goodenough, C.B.E., Executive Chairman of the B.C.G.A.

The new showrooms are an imposing addition to the business premises in Church Street, and are equipped and furnished on the most up-to-date lines. The semi-circular streamlined windows converge on a spacious entrance door, giving access to a roomy showroom, the walls of which are decorated with a ground of cream, picked out in art green. The facia of the shop front is of plain "snowcrete," on which in bold relief letters faced in red are the words "St. Austell Gas Company, Ltd." Three lamps, each of 600 candle power, on sturdy arms project from the facia. Both the floor and furniture are of oak. At the rear and above the showroom are the offices and storerooms.

A large company attended the opening ceremony presided over by Mr. S. J. Ingram, Chairman of the Company. In addition to Sir Francis and Lady Goodenough there were a number of prominent people connected with the Gas Industry in Cornwall, including Mr. T. H. Williams and Mr. G. J. Treleaven, Directors of the St. Austell Gas Company; Mr. N. E. Purcell, Chairman of the St. Blazey Gas Company, while Mr. A. G. Watkins, Chairman of the St. Austell Urban District Council, was also present.

The Chairman remarked that the opening of those new showrooms marked a new epoch in the development of the Gas Industry in St. Austell as well as of St. Austell's industries. They were honoured by the presence of Sir Francis Goodenough who was in the Gas Industry regarded with love, affection, and esteem.

In declaring the showrooms open, Sir Francis said it gave him very great pleasure to congratulate the St. Austell Gas Company on their enterprise in providing those fine showrooms for the service of the public. He also congratulated the architect (Mr. B. C. Andrew) on the modern ideas he had interpreted and in representing so well the spirit of progress.

Lady Goodenough was then presented with a beautiful bouquet of roses by Miss Jane Morton, daughter of Mr. R. Morton, Engineer, Manager, and Secretary of the Company.

The company then adjourned to the St. Austell Bay Hotel where they were entertained at luncheon by the St. Austell Gas Company.

Sir Francis Goodenough, in submitting "The St. Austell Gas Company, Ltd.," congratulated the St. Austell district on the up-to-date facilities provided them in the use of gas by the St. Austell Gas Company, the opening of their new showroom being indicative of their enterprise to render all the help they could to the public. He emphasized the importance of the use of gas in the household and mentioned that 75% of their consumers were women. It would be a source of gratification to St. Austell people to know that they had that day appointed Miss Riley (the daughter of the late Mr. Harold E. Riley, who was for many years Engineer and Manager of the St. Austell Gas Company) and who had rendered good services at the headquarters of the B.C.G.A., as Manageress of the new showrooms. In the step the St. Austell Gas Company had taken that day they were following in the wake of other gas enterprises in the West, including Bath, Exeter, and Torquay, where new developments had been undertaken. He was proud of the fact that the West was in the forefront of progress in the Gas Industry, which had a great future.

The Chairman, responding, referred to the great progress the Gas Industry had made since its commencement in St. Austell and he welcomed Sir Francis' testimony on its position in the West. He claimed that St. Austell consumers had always been well served by the Gas Company and compared its present predominating days with those of the old. Their faith in the future of the Industry was indicated by that new enterprise upon which they had embarked. He referred to the impending departure of Mr. Riley's successor—Mr. Robert Morton—who had received an important appointment as Manager and Engineer of the Dorchester Gas Company. Their regret at his going was tempered with the pleasure that it was a result of his labours there that he had secured a better position.

Alder & Mackay "arrive" at 12, City Road.

A New Industry on Tyneside

The Gas Industry of Northern England was widely represented at the official opening in Newcastle on Wednesday of last week of a new Branch Works of Messrs. Alder & Mackay, Ltd., of Edinburgh, the old-established firm of gas meter manufacturers

The new Works, which occupy two floors at No. 12, City Road, were inspected by a gathering which included the Lord Mayor of Newcastle (Councillor R. S. Dalgliesh), Alderman E. Gibbin (Chairman, Weights and Measures Department Committee), and Councillor T. H. Hurst (Chairman, City Lighting Committee). The Newcastle and Gateshead Gas Company were represented by the Chairman, Mr. John E. Cowen; Col. W. H. Ritson, C.M.G., Sir Cecil Cochrane, Sir Alexander Leith, Bt., M.C., D.L., Mr. Rowland Lishman and Mr. John D. Cowen, Directors; and Mr. T. P. Ridley, Commercial Manager and Secretary. Among representatives of neighbouring gas undertakings were Messrs. R. H. Duxbury (South Bank), A. E. Ruffhead (Darlington), G. W. Martin (Houghton), Dugald Currie (South Shields), J. Eadington (Blyth), and C. Turnbull (Alnwick).

The visitors were received at the Works by Mr. J. Miller Thomson, Chairman, Messrs. H. E. Bennet and William Grant, Managing Directors, and Messrs. Stanley Bennet and J. O. Scott, Directors of Alder & Mackay, Ltd.

The New Works.

The Works are spacious, well lighted, and conveniently situated, and, in addition to supplying certain of the requirements of the Newcastle Company, the new branch will act as Alder & Mackay's centre for Durham, Northumberland, and North Yorkshire.

The main floor has been equipped with benches and plant for the assembly of gas meters, the parts being supplied from the Edinburgh Works. One of the first things which caught the eye of the Lord Mayor was the Company's optional coin prepayment meter permitting the insertion of pennies or shillings at the option of the consumer. It was neatly exhibited in a glass casing thus showing its mechanical operation. The blow-pipes of the tinsmiths are supplied with gas at pressure provided by compressing plant. A gassing plant for testing the gas-tightness of the meters and a proving room fitted with the latest type machine for checking the accuracy of the meter readings were also inspected. The meters are painted by mechanical spray.

Experts from the Edinburgh Works are at present supervising the local skilled labour which has been engaged. The spaciousness of the Works will permit of expansion in production.

The "Launch" Celebrated.

After the inspection of the Works, the visitors were entertained at luncheon by Alder & Mackay, Ltd., at the Royal Station Hotel.

Mr. J. MILLER THOMSON presided and, proposing the toast of "The Lord Mayor and Corporation of the City and County of Newcastle-upon-Tyne," thanked the Lord Mayor and those present for their attendance. He looked upon the opening ceremony as the "launching" of Alder & Mackay's new and modest venture. To commemorate this, he asked them each to accept a memento—very appropriately a miniature of a sailing yacht neatly executed in chromiumed metal—as symbolic of that "launch" on the Tyne. Alder & Mackay were no strangers to Newcastle; they had done business with the Newcastle and Gateshead Gas Company for more than 80 years. Now they had a local habitation and name on Tyneside acknowledged by a civic welcome. Their long association with the Company indicated satisfaction on both sides. After all, there were nearly 300 parts in a gas meter to go wrong. Mr. Thomson spoke of the comparative histories of Edinburgh and Newcastle, and complimented the Lord Mayor on his efforts to introduce new industries to the district. He added that they intended to add to the association of the two cities by "digging themselves in" on Tyneside.

The LORD MAYOR, responding, said that this was one of his great days, in that he was welcoming a new industry to the City. He hoped the "vessel" they had launched would go far and prosper as many similar undertakings which had started in quite a modest way had done. Newcastle civic authorities got on very well with their privately-owned Gas Company; recently the price of gas had been reduced. He complimented the Board and the Company on its efficiency.

Mr. JOHN E. COWEN, proposing "The Chairman," thanked Mr. Thomson and his Company for an opportunity

At the entrance to the Works. Left to Right—Mr. H. E. Bennet, Mr. T. P. Ridley, Sir Cecil Cochrane, Mr. William Grant, the Lord Mayor, Mr. Miller Thomson, Mr. J. D. Cowen, and Mr. John E. Cowen.

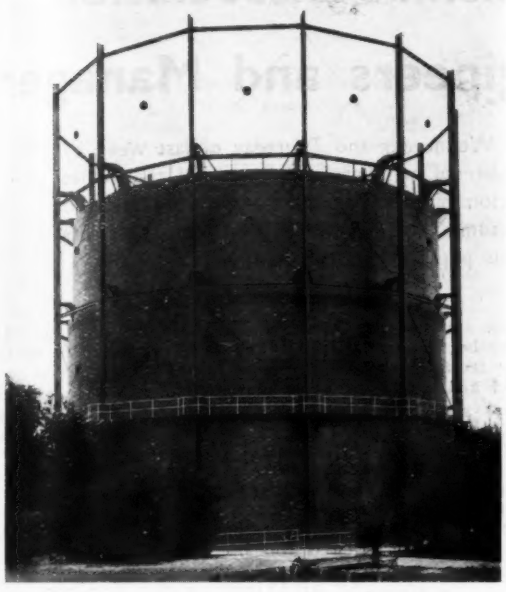
to inspect the new Works. Apart from his chairmanship of Alder & Mackay, Ltd., Mr. Thomson was associated with other undertakings allied to the Gas Industry, and was a distinguished lawyer in Edinburgh. Alder & Mackay would not expect him to say they were the *best* makers of gas meters—it was agreed there were other good firms—but it would be apparent to all that the long con-

nection which had existed between the two Companies could only have endured through thorough satisfaction on both sides. Alder & Mackay had made gas meters for his Company since 1854. In recent years, the Edinburgh firm had executed the major part of their gas meter work, and they were pleased that this had enabled them to establish a branch in Newcastle, since his Board were always anxious to do everything to attract new light industries to the district. They had, for example, undertaken extensions and replacement work and embarked on schemes which, but for their anxiety to assist the district in depressed times, they would not have done yet. They had also tried to help other companies to reduce costs by offering attractive industrial tariffs. During this month, they had again reduced the price of gas apart from the reduction in basic charges. During the last five years they had thus altogether made four reductions in price. The latest, like the others, faced them with a serious reduction in revenue on present consumption. They had confidence, however, that the reduction was such as to sell more gas. The efficiency of their Company had been referred to. It was to its credit that during the depression years they had only once recorded a decrease in gas sales and that had been of only 1%. Last year showed an increase of 4%, and sales so far this year indicated yet another.

The Chairman briefly responded to the toast.

Andover's New Gasholder

The progressive policy which the Andover Gas Company has always done its utmost to maintain was well demonstrated at the official opening on Sept. 19 of the new gasholder.



The holder was put into action by the Mayor of Andover, Mr. B. Shaw Porter, who, at the invitation of the Chairman (Mr. W. P. Clarke), the Directors, and shareholders, was accompanied by a large number of the members of the Town Council.

The Contractors for the foundations of the holder, which was erected by Messrs. C. & W. Walker, Ltd., were Messrs. Robinson & Co. Mr. Geo. Evetts acted as Consulting Engineer. Owing to the unsatisfactory nature of the ground it was decided to pile the site with 100 " Vibro " piles averaging 40 ft. in depth carrying a reinforced concrete raft on which the holder and tank were erected. The whole of Messrs. Walker's work was completed within six months.

Mr. G. T. Temblett, the Manager and Secretary of the Company, expressed everyone's thanks to the Mayor and went on to say that the foundation stone of the Company had been laid by Thomas Heath in 1838. Public lighting by gas came about either at that time or a little later. Ever since that day the Directors had endeavoured to give the finest possible service. At the present day, owing to changed conditions of traffic, higher standards of lighting were in demand, and suggestions were being made that money should be provided for this out of the Road Fund. The Company, in Andover at least, was able to provide any standard of lighting that might be called for.

Mr. Milbourne, representing Messrs. C. & W. Walker, then made a presentation to the Mayor of a handsome rose-bowl. Giving a few facts about the holder, Mr. Milbourne said that its capacity was 350,000 cu.ft. and there was nearly 300 tons of steelwork in the structure. As shareholders they could be congratulated on the zeal which their

A Group of those present at the official inauguration of Andover's new gasholder.

Directors had displayed in going in for this particular form of holder, upon the design of which the Engineer was to be congratulated. His firm had put the very best of British material and workmanship into the structure, and there was no reason why it should not be working for the next 50, 60, or 70 years without any attention.

The Mayor first thanked Mr. Temblett for asking the Corporation and himself to perform the little ceremony, and then Mr. Milbourne and his firm. In paying a tribute to the high standard of street lighting in Andover, the Mayor remarked that not so long ago the Deputy Mayor of Salisbury had occasion to come to a dinner at Andover, and took the opportunity of remarking in his speech how impressed he had been by the street lighting.

The Chairman remarked on the fact that a great deal of the work in connection with the gasholder had fallen to Mr. Temblett, and it was only just that the credit should do likewise.

Tea was then served, and later some of the guests took the opportunity of making a tour of inspection of the Gas-Works, and expressed themselves highly satisfied with the degree of efficiency exhibited on every side.

The Wales and Monmouthshire Association of Gas Engineers and Managers

AUTUMN
GENERAL MEETING
AT
PORTHCAWL,
SEPTEMBER 18 and 19.

Porthcawl was enlivened on Wednesday and Thursday of last week by the presence of a large number of members and friends of the Wales and Monmouthshire Association of Gas Engineers and Managers, who had assembled for the Autumn Meeting, which for years past has taken place in this popular part of South Wales.

The business was transacted in the Grand Pavilion, on the Esplanade, with the Retiring President, Mr. HAROLD BARKER, of Llanelly, in the chair during the earlier part of the proceedings.

The Membership Roll.

After the minutes of the last two meetings had been read by Mr. OCTAVIUS THOMAS (the Hon. Secretary and Treasurer), the following additions were made to the membership roll:

Ordinary Members.

R. W. Foster (Cardiff).
S. L. Filer (Tredegar).

Associates.

Frank Bird (Cardiff).
P. R. Morgan (Cardiff).
H. W. Smith (Walsall).

Presidential Affairs.

Mr. BARKER then introduced to the meeting the new President, Mr. H. Matterface, of Monmouth, of whose qualifications for the office he spoke in cordial terms.

Mr. MATTERFACE, on taking the chair, amid hearty greetings, thanked the retiring President, on behalf of the members, for the good work he had done for the Association during his year of office. As a memento of his Presidency, he presented Mr. Barker with a handsome inscribed salver.

Matters Financial.

Mr. BARKER, acknowledging the gift, which he said would be treasured by him as a reminder of a happy year, remarked that he could not conclude his Presidency without one or two words more with regard to the affairs of the Industry as he saw them at the present time. The competition they were up against was as acute as ever, and they required all their energies and all the resources at their command to enable them to successfully combat it. He would like to remind them of what he had said on this subject in his Presidential Address at Llanelly—that though they had in the past had assistance from the manufacturers of gas appliances, who had given them modern and efficient appliances, still they could not say that they had had material reductions in the prices. So far as he could see, the suppliers of the various apparatus which they needed for carrying on their work of supplying gas to their consumers had not taken the hint he then threw out that they would all be glad to see prices come down. Rather were they helping the competitors of the Industry by increasing the prices of the goods they supplied. It had to be remembered that the Gas Industry paid "on the nail" for the apparatus purchased, and then had to wait in many cases for some years before getting the whole of the cash back from the consumers. Instead of coming down, he greatly regretted that prices were showing a tendency to go up. The higher the prices they had to pay for the articles they had to use in their business, the better would be the opportunity for their competitors to take away from them the present consumers of gas. So he would again put it to the suppliers of the articles which the Gas Industry had to buy, that the sooner they brought down their prices and gave a reasonable dividend to their shareholders, the better chance would the Gas Industry in that part of the country have of holding its own.

He would like, in conclusion, to say that any work done for the Association during his year of office had been mainly due to the exertions of their devoted Hon. Secretary and of Mr. Wilfred Jones.

Presentation of Prizes to the Juniors.

The next item on the agenda was the presentation of certificates and prizes to members of the Wales and Monmouthshire Junior Gas Association. This duty was undertaken by Mr. Ross Taylor.

The PRESIDENT said these presentations formed a part of the proceedings of their Association of which they ought to feel very proud. Theirs was the only Gas Association to present prizes to the junior members, and they owed a debt of gratitude to Mr. Thomas for the origination of the scheme some ten years ago. It would be a very good thing if the other District Associations could see their way to follow the lead. He was sure Mr. Thomas would not mind them taking a leaf out of his book.

The prizes were as follows:

For work done for the Wales and Monmouthshire Junior Gas Association.

A. D. Howells	Abergavenny
J. H. Canning, Junr.	Newport
F. Stuart Johns	Swansea
G. E. Thomas	Neath
D. E. West	Port Talbot

For passing Examinations of The Institution of Gas Engineers.—

Higher Grade Gas Engineering, 2nd Class.

A. D. C. Gunn	Cardiff

Higher Grade Gas Supply, 2nd Class.

T. F. Edwards	Newport

Ordinary Grade Gas Engineering, 2nd Class.

N. H. Greenway	Cardiff
J. F. Iles	,,

Ordinary Grade Gas Supply, 2nd Class.

J. J. Asquith	Newport
J. F. Carless	,,

City and Guilds of London Examinations, Gas Fitting, Grade 1.

Ronald C. Drewell	Newport
William Martin	,,
Kenneth L. Furnell	,,
Thomas Rendell	,,

Cardiff Technical College Internal Examinations.— Gas Engineering, Stage 1.

K. M. Ernest	Cardiff

Cardiff Technical College Internal Examinations.—Gas Supply, Stage 1.

A. G. T. Blake	Cardiff
F. G. Brown	,,
J. Gabe	,,
T. Cavanagh	,,
K. E. Muir	,,
G. Osborne	,,

Cardiff Technical College Internal Examinations.—Gas Engineering, Stage 2.

W. A. Pask	Caldicot

Cardiff Technical College Internal Examinations.—Gas Fitting, Stage 1.

C. R Bielski	Cardiff
H. C. Carey	,,
W. S Llewellyn	,,
R. J. Perry	,,
H. E. Rees	,,

Cardiff Technical College Internal Examinations.—Gas Fitting, Stage 2.

K. K. Williams	Cardiff
E. Francis	Barry
A. Ellett	,,
D. Rees	,,

Cardiff Technical College Internal Examinations.- Gas Fitting, Stage 3.

A. T. Cottrell	Cardiff
E. D. Cresta	,,
S. Price	,,

Cardiff Technical College Internal Examinations.—Gas Fitting, Stage 4.

B. E. Kemp	Cardiff

Cardiff Technical College Internal Examinations.—Gas Engineering, Stage 1.

D. J. Heycock	Port Talbot

Cardiff Technical College Internal Examinations.—Gas Supply, Stage 2.

W. N. Little	Cardiff
W. Francis Edwards	Caerphilly
S. J. Glover	Barry

Importance of Technical Education.

Mr. W. Ross Taylor, of the National Gas Council, said he greatly appreciated the honour of being asked to hand over these prizes, and he was in complete accord with what the President had said regarding the value of such a scheme for encouraging the younger members of the Industry. It was an admirable scheme, and ought to be extended in other directions. He had been present at a good many of these functions in connection with their Association, and had always been struck by the fine-looking young men who came forward to take these prizes. They gave every promise of being able efficiently to carry on the work of the Gas Industry in South Wales. He congratulated them upon the work which had brought to them these well-merited awards. He would once again urge the vital importance of technical education. The Gas Industry was faced with very keen competition, and it would be only if those engaged in it were thoroughly fitted to carry out their part that it could hope for success. When he saw those who were in South Wales coming along to "carry the flag," he felt no kind of fear that the Industry would lose its proud position. Rather was he convinced that it would go forward to still greater things in the future.

Special Purposes Section.

On the proposition of Mr. A. E. Pask (Caldicot), seconded by Mr. E. Ablett (Swansea), the 25th annual report of the Special Purposes Section was adopted.

This stated that two meetings had been held during the year. The membership consisted of 10 local authorities and 22 companies. Fortnightly reports of the stocks of coke, together with the prices received, had been circulated. The Committee decided to take part in the Industrial Exhibition in the Greyfriars Hall, Cardiff, last March. This exhibition, which was arranged by the Industrial Development Council of South Wales and Monmouthshire, proved very successful. Thanks were due to Mr. H. D. Madden and his staff for the efficient manner in which the stand was arranged. The receipts of the Section for the year amounted to £43 12s. 4d., and the payments to £45 4s. 3d., leaving, with the balance brought forward, the sum of £55 8s. 7d. in the hands of the Treasurer, together with £300 of 2½% Consols.

The report was signed by the Chairman, Mr. James E. Kenshole.

Refractory Materials.

Mr. A. T. Green, F.I.C., Assistant Director to the British Refractories Research Association, then lectured on refractory materials. He dealt with the strength and weaknesses of fireclay bricks and silica material in such a way as to hold the attention of his audience throughout, without a single break.

An abstract of the lecture, and of the discussion by which it was followed, will be dealt with in a subsequent issue of the "Journal."

Announcements.

It having been agreed that the place of next meeting should be left to the Council to decide upon,

The Hon. Secretary asked members to make a note of the fact that a Women's Gas Council had come into being, with the object of improving the standard of home life. The work of the Council will be carried on by local branches formed in towns throughout the country. Mr. Thomas asked those interested to communicate with the Organizing Secretary, Miss Kathleen M. Halpin, at 19-20, Grosvenor Place, London, S.W. 1.

Luncheon.

Business concluded, there was an adjournment to the Esplanade Hotel, where members and guests to the number of well over one hundred sat down to luncheon.

Mr. G. H. Powell, Chairman of the Monmouth Gas and Water Works Company, proposing "Prosperity to the Town and Trade of Porthcawl," said some nice things, with which his hearers were in cordial agreement.

Mr. Jenkin Phillips, Chairman of the Porthcawl Urban District Council, in reply, declared that the finest investment the town had ever made was in the change-over from the old system of carbonization to the new, and he wanted to take this opportunity of paying a tribute to West's Gas Improvement Company for the very valuable help they had rendered in the provision of the new plant. The promenade was now lighted by high-pressure gas lamps, which had successfully withstood the test of the most fierce gales ever experienced. There had been long debates in the Council as to whether they should have gas or electricity, but everyone must now agree that the high-pressure gas lighting was equal to any form of electricity.

Mr. M. H. Simmonds, a Director of the Monmouth Gas and Water Company, at this stage presented the Golf Cups to Mr. A. D. Howells and Mr. M. H. Thornton.

Gas the Best Friend of Coal.

Mr. Ross Taylor, as representing the National Gas Council, submitted the toast of "The Association." Speaking from his considerable experience of it, he said he knew the Association to be a most active and live body. This was in great measure due to the fact that it had for its Secretary one of the best possible men for the purpose. [Applause.] The Association had been in existence for thirty years, and Mr. Thomas had been Secretary for the whole of that time, and President on two occasions in addition. To-day there were no less than 140 members. He welcomed this opportunity of offering the greetings of the National Gas Council, and of thanking the Association for the support which it always gave to the Council, both directly and indirectly. They all hoped that, as soon as the regulations permitted, they would have Mr. Canning back again as a member of the Central Executive Board. Wales had strongly taken up the policy of pushing the use of gas for industrial purposes. Thanks greatly to the Cardiff Gas Light and Coke Company, who had rendered the movement possible, a centre had been laid down on sound foundations which had already done admirable work. If the Gas Industry was to survive, it must advance. Research in every direction was needed, and the Development Centres throughout the country were doing excellent work in this way. Those who remained outside the scheme were putting upon themselves a severe and unnecessary handicap. Another direction in which the Association supported the Central Body was in the matter of coal prices. A firm attitude had always been adopted towards those who wished to increase the cost of supplies of coal to public utilities. It was a very short-sighted policy not to recognize gas as the best friend of coal. If there was to be any change, then coal should be cheaper. Any improvement in the coal industry must come from a general expansion of industry at home, and seeing that gas could contribute largely to this expansion it must be a bad policy from the point of view of the coal suppliers to make it necessary for the gas undertakings to charge more for their gas.

Mr. Matterface, responding, made reference to the areas from which trade is drifting away, and said he thought it was a pity for big factories to move towards London. The Government should do what they could to get new factories erected in districts where there were already the necessary workpeople and houses available. He admired the high-pressure lighting on the promenade at Porthcawl. In Monmouth they had no gas street lighting. Lately forty new houses had been put up in the town, and the Gas Company were asked to quote for fitting them with gas. Their quotation was "Nothing." Afterwards

there was a contract at so much per house to fit up with electricity.

Golf Competitions.

On the day preceding the meeting, the Association's usual golf competitions took place. On this occasion, play was on the beautifully situated Southerndown Links, near Bridgend. Fairly good weather was experienced, though a very strong wind somewhat interfered with the prowess of the competitors. This was the one eventuality against which Mr. J. Sadler, in his usual excellent and far-sighted arrangements, had been unable to make provision.

Upjohn Cup.

The morning competition was by medal play, and resulted as follows:

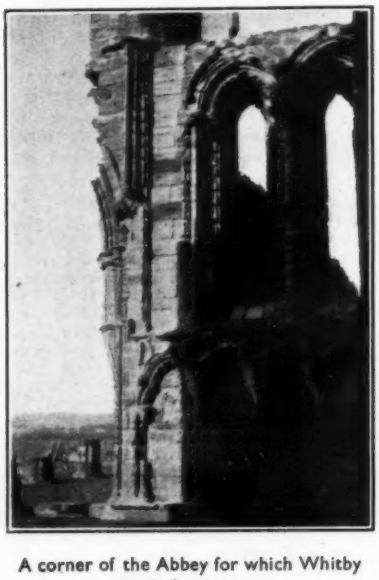
A. D. Howells	99 – 24 = 75
C. L. Bury	95 – 18 = 77
W. Clark Jackson	82 – 4 = 78
S. C. Whitfield	96 – 16 = 80

Wilfred Dean Cup.

In the afternoon there were bogey singles with the following result:

M. H. Thornton	1 down
C. A. King	6 ,,
F. Boardman	6 ,,
E. Ablett	7 ,,
C. L. Bury	8 ,,

Subsequently 44 sat down to the customary golf dinner in the Esplanade Hotel, with Mr. R. J. Auckland in the chair. Messages were read from Mr. H. D. Madden and Mr. J. H. Canning expressing regret at inability to be present; and special welcomes were extended to Mr. A. T. Green and to Mr. W. Ross Taylor, who afterwards distributed the prizes. The Secretary of the Golf Club was present, and to him was expressed the appreciation of the visitors at having been permitted to play that day on such a first-rate course.



A corner of the Abbey for which Whitby is famous.

North of England Gas Managers' Association

AUTUMN MEETING AT WHITBY

The Autumn Meeting of the North of England Gas Managers' Association was held on Friday, Sept. 20, at the Crown Hotel, Whitby, under the Presidency of Mr. W. M. GALLEWAY, who is Engineer, Manager, and Secretary of the Whitby Gas Company

The Association Luncheon.

At the luncheon in the Crown Hotel, which preceded the meeting, the PRESIDENT was in the chair, and, the Loyal Toast having been duly honoured, a welcome was offered to the Association by Capt. R. SMAILES, J.P., C.C. (Chairman of the Whitby Gas Company).

It afforded him, he said, the greatest pleasure to welcome the members to their old town, and he was pleased to see such a large number present. They regarded the visit as a great compliment to their Manager, Mr. Galleway, who had won the esteem of their members as evidenced by his election as their President for the present year. His fellow Directors joined with him in wishing them all a most successful meeting and prosperity during the coming year. He would like to take the opportunity of letting them know that his fellow Directors had the fullest confidence in the ability of their President, who had proved himself both a clever Manager and Accountant. When first he met Mr. Galleway in the year 1890 he was employed as Accountant in the Whitby Harbour Trustees Office and occupied his spare time in teaching shorthand. On entering the Gas Company's service he quickly became interested in the work and determined not only to master the accounts but the method of gas production. By persevering he taught himself the principles and made himself familiar with the practical side of gas manufacure, which enabled him to pass the examinations and become a fully qualified Gas Engineer. He was sure they would agree with him that this was most creditable of him and was a splendid example to the younger men—to illustrate what could be accomplished by perseverance and attention to business.

There was another point, continued Capt. Smailes, to which he must refer—that was, the cordial relations which existed among the staff of the Company, both office and works. Their Manager treated them all fairly and sympathetically, so that they did not have any trouble, and all worked together for the benefit of the Company. For the past twenty-six years he had been a Director of the Company. It was a pleasure to attend their monthly meetings: his colleagues would agree that the accounts were carefully kept, and they always had a clear explanation of any requirements by the Manager before sanctioning the expenditure.

In conclusion, he expressed the hope that they would enjoy their short visit to Whitby and that what they saw would encourage them to come next year for a longer stay.

An Opportunity for Keeping Up-to-Date.

The PRESIDENT, in responding, tendered on behalf of the Association their grateful thanks for the expression of goodwill towards the Association and himself. They were delighted to meet under these auspices, and he thanked the Directors most cordially for all they had done to make their visit a successful one. These Association meetings marked for the Gas Engineer occasions of friendly intercourse and business benefit. Their members came together from districts as widely separated as Edinburgh, Hull, and Bridlington, and while lunch on such occasions was necessary, it did not by any means constitute the main purpose of the meeting. The friendly intercourse which took place between business men who were geographically isolated from one another gave the Gas Industry an opportunity for the dissemination of views and for keeping thoroughly up to date. During twenty-seven years of membership of this Association he had gained very great benefit from these meetings. He had made personal contacts and many friends whom he valued very highly, and it was a great pleasure to him to have with him that day men with whom he had been associated since his first connection with the North of England Association.

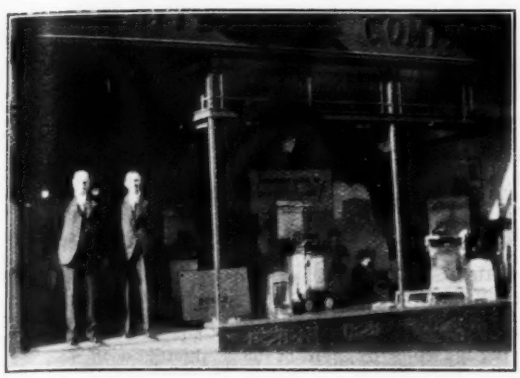
They were under a great debt of gratitude to the men who had preceded him in guiding the affairs of the Association for so many years. They were particularly indebted to one of their past-Presidents, whose name he would not mention, for the interest that had been taken in the education of the rising generation of engineers. It used to be said that gas was a back number, but it was now realized that vistas marked for the Industry a future which had never been visualized in their wildest dreams.

In conclusion, Mr. Galleway thanked Capt. Smailes once more on behalf of the Association most cordially for the welcome he had extended to them, and he could only trust that their Asso-

ciation and the Company he had the honour to serve would continue as they were both justified in continuing.

The Town of Whitby.

Mr. W. A. OLDFIELD (Deputy-Chairman of the Whitby Gas Company), proposing the Toast of "The Town and Trade of Whitby," said how delighted they were to have with them the Chairman of their Urban District Council and their chief citizen, Mr. W. B. Sinclair. He had been known in the town for many years before he attained his present eminent position, and they would like to congratulate him upon reaching that



The President and the Hon. Secretary outside the Gas Showrooms.

position. At the same time he would congratulate the Urban District Council upon having at its head a man so eminent and practical. It was perfectly natural for everyone to have a love for his own town, and to be a citizen of Whitby was no mean honour. It was his hope and intention, he added, to continue his business life in Whitby so long as his business life there would support him. Whitby had behind it a famous and glorious tradition of which any town might be proud. Might its future be equally inspiring.

As regards the trade of Whitby, many of its time-honoured industries had gone; but he saw no reason to be pessimistic in regard to its future, which might be looked forward to with a certain degree of confidence. The Whitby Gas Company had served the trading interests of the Town for a hundred years, and it might safely claim to be the oldest trading institution in the town. It was, indeed, so closely identified with the town that in proposing this Toast he was echoing good wishes to the Company, and it was in that spirit that he asked them to drink this Toast, coupling with it the name of Mr. Sinclair.

Mr. W. B. SINCLAIR, J.P. (Chairman of the Whitby Urban District Council), in responding to the Toast, which was heartily accorded, said that so far as the town and trade of Whitby was concerned, the town was making rapid progress. The Council had made many improvements for the good of the town generally, and they intended to make many more yet. It was their intention to make it one of the best health resorts in England. They were proud of the town in which they lived, and everyone who came there was equally proud. He hoped they would go away with good impressions of the town. They were pleased to see them every one. In conclusion, he thanked them for the invitation to attend their meeting, and he hoped it would be a happy and prosperous one for all concerned.

Business Meeting.

The minutes of the previous meeting having been taken as read, the President referred with regret to the death since their last meeting of one of their members—namely, Mr. H. Tobey, and those present stood for a moment as a mark of respect to his memory.

The HON. SECRETARY (Mr. H. Douglas Lees, of Hexham) read the letters of regret for absence, after which Mr. I. M. Hardacre (Berwick) was elected to membership of the Association.

Institution Examination Successes.

The HON. SECRETARY then read out the names of the following candidates in the North of England area who had been successful in The Institution of Gas Engineers' Examinations in Gas Engineering and Gas Supply:

GAS ENGINEERING.

HIGHER GRADE.

1st class	J. Smith	Workington
2nd ,,	J. Gaskarth	Maryport
2nd ,,	W. E. Weatherley	Hexham

ORDINARY GRADE

1st class	J. R. Clark	Newcastle
2nd ,,	S. E. Wright	Stockton

GAS SUPPLY.

HIGHER GRADE.

2nd class	W. Brooks	Chester-le-Street
2nd ,,	F. T. Cooper	Workington
2nd ,,	G. Norton	Newcastle
2nd ,,	E. Proud	,,

ORDINARY GRADE.

1st class	H. Curle	Sunderland
1st ,,	J. C. Graham	Newcastle
1st ,,	J. E. McManus	Willington Quay
2nd ,,	F. A. Poole	Sunderland
2nd ,,	H. W. Watson	Durham
2nd ,,	S. A. Watson	Newcastle

The PRESIDENT congratulated these candidates and expressed the hope that their futures would be successful.

Mr. GALLEWAY then proceeded to deliver his Presidential Address, which will be found on other pages of this issue.

Vote of Thanks.

Mr. T. LAW (Malton) proposed a very hearty vote of thanks to their President for his most interesting Address. It was a special pleasure for him to have the opportunity of doing so because when he first went to Malton Mr. Galleway had gone to see him, and their relations since that time—sixteen years ago—had always been of the friendliest. He thought they would agree with him that their President had added lustre to that high office and had filled the position in an excellent manner. He had whispered to Mr. Law when he was elected that his chief difficulty would be in writing his Presidential Address; but he need not have had any qualms, for the Address he had just delivered was a most interesting and instructive one. He had mentioned a James Malam as Engineer in 1837, so that it would seem that Whitby and Malton had something in common, for the Engineer at Malton at the same time was James Malam, and he thought they would be one and the same person.

He considered that Mr. Galleway was right in using the best coal because of its increased gas-making qualities and the excellent coke which it produced—which was proved by the analysis given in the Address. Mr. Law had himself had similar experience in regard to shortage of pressure, but instead of placing the metal in the cup he had increased the pressure by H pieces of iron bolted together and fixed on the outside of the crown of the holder. An advantage of this method was that the bolts could be easily taken out and the metal removed in sections for

The President and Council.

repainting. Mr. Law went on to congratulate their President on the sale of gas apparatus; for to sell over 400 cookers in five years in addition to more than 500 fires and boilers was very gratifying. He was afraid they did not go quite so far as the President did in laying mains and services free; they only did this in the case of houses using gas for all purposes. If it were only used for cooking and washing they charged for over 30 ft. He was fully in agreement with the President's remarks in regard to the rating of gas undertakings, as many were unfairly assessed.

Mr. H. LEES (Hexham) seconded the vote of thanks and in doing so he referred to Mr. Galleway's youthful outlook. So long as men like Mr. Galleway continued to in-

fuse those around them with interest and enthusiasm gas would not be considered a back number.

A Demonstration of Calor-Gas.

The PRESIDENT having duly acknowledged the vote, the members were given a demonstration of Calor-Gas by Mr. Saville, of Messrs. F. C. Sugden & Co., Ltd., of Leeds, who are the distributors for the area. A hotplate and lighting burner were shown in operation, and Mr. Galleway spoke highly of the value of this gas for consumers beyond the reach of the coal gas mains.

During the course of the afternoon the members had the opportunity of inspecting the gas-works, the showrooms, and local places of interest before reassembling at the Crown Hotel for tea by kind invitation of the Directors of the Whitby Gas Company. The indebtedness of the Association to the Company was ably voiced by Mr. J. CORRIGAN (Penrith), the Vice-President, who said that a great deal of work was involved in arranging meetings of this nature, and he hoped that Mr. Galleway and his staff would realize how much they appreciated all that had been done for them that day.

Mr. W. A. OLDFIELD responded on behalf of the Company, remarking that their visit had been extremely well repaid to the Company.

The Flash System of Carburetting

by THEODORE NAGEL

A Description of a Continuous Gas Process, reprinted from the July issue of the *American Gas Journal*. The Author is Vice-President and Chief Engineer of Carburetted Gas Inc., New York.

Statistics of the Gas Industry in the United States for the year 1930, compiled by the American Gas Association, show carburetted water gas was 48% of the total manufactured gas sold to public utility customers.

Improvements of a minor order have been made in the gas making equipment, the most notable being the automatic cycle control, the automatic grate and automatic ash removal, back-run connection to the generator, and, within the past five years, gas-oil displacement by heavier oil for water gas enrichment.

Having similar composition and characteristics or specifications of carburetted water gas, public utility gas can be generated in a single shell gas machine by a continuous flash system using oxygen and heavy-oil (oil of lower cost than gas-oil) for gas making.

This flash system continuous generation of carburetted blue gas eliminates the usual carburettor and superheater chambers with their periodic chequer brick renewals, does away with solid fuel storage and handling as well as ash disposal, and also eliminates boiler plant operations for generating steam used for water gas production to effect substantial economies in gas production through lower cost of gas making materials, less labour with lowered plant operations cost, and fixed charges on lower plant capital cost.

Compressed air, from which the nitrogen is automatically separated through counter-flow heat exchange liquefying and rectifying the air, provides a continuous electric power load for operating motor driven air compressors to produce a continuous supply of oxygen.

The ingredients for the flash production of 1,000 cu.ft. gas of public utility standard specifications having a thermal value of 540 B.Th.U. per cu.ft. amount to 5 galls. oil (bunker C fuel-oil or similar type heavy-oil) and for the necessary oxygen 4 kWh, which is equivalent to a continuous power service of 167 kW when generating 1 million cu.ft. of town gas in 24 hours. In a populated district consuming gas generated by this continuous flash system the public utility gas plant will be an industrial power consumer of the first magnitude.

Continuous flow gas production, as described, the most economical and ideal method for gas generation, has been the ambition and the dream of the gas man for many years.

Low-Cost Plants for Gaseous Oxygen.

In excess of 3 billion cu.ft. of 99·5% purity oxygen was sold in the United States in 1929, the output from 156 plants which have production capacity to provide for the probable increase in demand for high cost pure oxygen for many years to come. Practically all these oxygen plants are of small units, capacities under 5 tons oxygen daily output.

The pure oxygen output from these plants, largely supplied in cylinders, is primarily used for welding and cutting metals. A few liquid air plants have recently been located adjacent to and supply gaseous oxygen through pipe lines to steel plants on long term contracts. The lowest price for this service, reported in 1932, was $2.80 per 1,000 cu.ft., equivalent to $66.00 per net ton oxygen.

High capital cost of plants and high production cost of pure oxygen have made the extensive use of oxygen prohibitive in metallurgical and other industries.

Availability of Oxygen.

Post-war improvements in the art of air liquefaction and rectification have made rapid strides in effecting a radical reduction of the initial air compression, and as power consumption is the major cost item of oxygen production it is readily appreciated the influence reduced pressure has in production cost of oxygen as well as lower cost of plant equipment. Lower plant cost is further realized when producing gaseous oxygen of 95% purity with recovery of 95% of the oxygen content of the compressed air in contrast with the high oxygen loss entailed in rectifying oxygen to a purity of 99·5%.

Air liquefaction plants producing 95% purity oxygen, located on the site of consumption, can provide gaseous oxygen at a plant production cost of $3.50 per net ton with power at ½ cent/kWh and $5.00 per net ton with power at ¾ cent/kWh when producing at the rate of 150 tons daily from three single units, each of 50 tons capacity. These oxygen costs are equivalent to 15 cents and 21 cents per 1,000 cu.ft., respectively.

For producing 95% purity oxygen, air liquefaction and rectification plants design, plant construction costs, plant operation costs, technologists experienced on process and plant design, fabrication and operation, also patent protection covering process and design are available.

"Cracking" Heavy-Oil to Fixed Gas Enrichment.

In "cracking" oil to gas enrichment, heat-intensity and duration of time-of-contact with the maximum temperature are variables unknown to the gas maker.

As the temperature zone required for carburetting "lean" gas is considerably higher than the temperature zone of oil refinery practice the co-relation of heat-intensity and time-of-contact in the higher temperature gas zone, of little interest in oil refining, has received scant attention by hydrocarbon technologists.

"Cracking" oil to fixed gaseous hydrocarbons requires definite input to the oil of energy in the form of heat at definite heat-intensity.

Heat-intensity and time-of-contact regulate the thermal value of the fixed gas as well as the conversion of oil to gas and can be controlled to convert practically all the oil to gas to the practical exclusion of drip oil and tar formation, products of polymerizing reactions of the simpler hydrocarbons, the result of prolonged heating.

Part of the energy input to the oil is supplied by preheating the oil in pressure pipe stills. The heat deficiency required to "crack" the oil to fixed gas enrichment is supplied by the blue gas which contains heat for this purpose in excess of its carburetting temperature.

Oil heavier than gas-oil is used for generating blue gas from oil and oxygen. Blue gas enriched with 1,600 B.Th.U. gas by the flash system of "cracking" heavy-oil in the hot blue gas produces

—	540 B.Th.U / Cu.Ft.	800 B.Th.U./ Cu.Ft.	1,000 B.Th.U. Cu.Ft.
	%	%	%
CO	39	30	21
H_2	37	30	23
Paraffins	7	15	22
Olefins	10	20	31
$CO_2 + N_2$	7	5	3
	100	100	100

Technical data support and "cracking" tests confirm this flash system of generating carburetted blue gas from heavy oil and oxygen. These gas operations are subject matters of patents and patent applications.

NORTH OF ENGLAND ASSOCIATION

OF GAS MANAGERS

Presidential Address

OF

W. M. GALLEWAY

(Engineer, Manager, and Secretary of the Whitby Gas Company)

Delivered at the Autumn General Meeting of the Association held at the Crown Hotel, Whitby, on Friday, Sept. 20.

THE PRESIDENT,

W. M. GALLEWAY, of Whitby.

Mr. W. M. Galleway entered the Industry in 1892 when he was appointed Accountant to the Whitby Gas Company. Seven years later he became Secretary of the Company and in 1906 he accepted the joint position of Secretary and Manager. He holds the Honours Certificate of the City and Guilds of London Institute for Gas Manufacture and Distribution. Mr. Galleway was a member of the Whitby Board of Guardians for twelve years, of which he was Chairman for three years and Chairman of the Finance Committee for a similar period. He has been a member of the Whitby Assessment Committee for the past fifteen years and has been on the Management and House Committees of the Local War Memorial Cottage Hospital for a considerable time. He is a Freemason and a founder member and past-president of the Whitby Rotary Club.

My first words must be to tender you my most cordial thanks for the honour you have conferred on me by electing me to the distinguished Office of President of your Association. This Office has been held by many men who have eminently distinguished themselves in our profession. While I cannot claim any special ability, I will promise to do my best to maintain the traditions and promote the prosperity of the Association. When I entered the employ of the Whitby Gas Company as Accountant it was without any thought of ever occupying the position of Secretary and Manager of a Gas Undertaking, but "there's a divinity that shapes our ends, rough-hew them how we will." There have been so many Papers written on the subject of gas manufacture, &c., that it is difficult for a President to break fresh ground, and, therefore, I trust you will bear with me while I endeavour to give you a few incidents in the re-organization of the Undertaking which I have the honour to serve.

We hear a great deal at the present time of supplies of gas in portable cylinders. There has recently come into my possession extracts from the *Whitby Panorama* of 1827, for which I am indebted to my Chairman, on the subject of gas and its introduction to Whitby in which it is interesting to note that concerning the provision of portable gas there occurs the following:

> "Since the plans for providing portable gas condensed in vessels fitted to contain it, gas lights have been applied to purposes for which in the first instance they seemed not at all adapted. Among these the lighting of coaches with portable gas is at once pleasing and beneficial. It has been successfully tried in the Metropolis and has very recently been introduced into Scotland with similar success. One of the evening coaches ("The Enterprize") running between Edinburgh and Glasgow being brilliantly lighted up with gas all the way."

Also,

Gas Used as a Mast Head Light.

> "This is another application of portable gas recently tried and found to answer. The first of the kind we have heard of was lately announced in the *Glasgow Chronicle* as having been made on board a steam packet at a very recent date—and should this plan succeed and be extensively adopted it may be the means of saving many lives and much property. May it not be extremely useful with the same view to our lighthouses being lighted with gas where it is practical? The superior brilliancy of gas light would enable ships to discover the lighthouse at a much greater distance as well as to distinguish them with more accuracy from any other lights that may be seen on the shore."

Early Difficulties.

The same paper contains an account of the First Annual General Meeting of the Proprietors of the Whitby Oil Gas Light Company held on Monday, Nov. 26, 1827, at which it was reported that considerable difficulty had been encountered chiefly connected with Law Proceedings. It was also reported that as authorized at the last General Meeting a Committee had been sent to some towns with oil gas to inspect and report. The Committee was authorized to proceed with the erection of the Works. The principal difficulty, however, was in conveying gas across the river. Pedestrian and vehicular traffic across the river was, and is, by means of a swing bridge opened as occasion requires to let vessels pass from the lower to the upper harbour. The gas mains were laid down from each side and across the bed of the river. Vessels passing through at neap tides frequently caused damage to the mains and cut off the gas supply. This interruption became so frequent that in 1862 arrangements were made with the Harbour Trustees to lay a main across the river at a ford in the upper harbour, but this did not give complete immunity, as will be learnt later.

Mention is also made of the good fortune in the selection of Christopher Swales, not merely as a labourer and gas-maker, but on account of his superior abilities and scientific knowledge which, joined to his excellent character of probity and industry, justly entitled him to every commendation. It is also stated from the want of some practical person as superintendent of the general concerns of the Company much inconvenience was sustained, and Mr. Giddeon Buck, from the previous knowledge he had obtained, was elected to fill that important station at a salary of £20 per annum! From his unwearied care and attention the Committee were persuaded that the Company had most materially benefited. A collecting clerk was engaged at the commencing of the Works at a similar salary.

The Committee reported that as a result of the high price of oil and the very great expense attending the making of gas they had been compelled to charge the consumers the sum of 50s. per 1,000 cu.ft., and under existing circumstances they did not think it right to hold out any hopes of its being sold at present below that price. . . . A dividend of 5% was declared, and the Committee, in responding to the vote of thanks, suggested that theirs was probably the only Company which had carried its designs into execution within the amount of their subscribed capital, and stated that the expenditure would have been considerably less if the Company had not been obliged to purchase gas meters for each consumer—a circumstance unforeseen at the formation of the Company.

The First Works.

The Works were situated on the east side of the town in a very congested area, and a tablet let into the outer wall bears an inscription "James Malam, Engineer, 1837." There was also a small Works on the west side of the river. Up to 1859 they were under the private ownership of Dr. Atkinson. In 1859 they came into the possession of his son, Anthony Owst Atkinson, who bought them from the mortgagees for the amount they had advanced upon them—namely, £13,700. They were transferred to a Limited Company, which was incorporated under the Companies Acts, 1862 and 1867, under the title of the Whitby Gas Company, Ltd.

The Whitby Gas Company was incorporated in 1871 with a capital of £33,000—£18,000 original and £15,000 additional. The Town Authorities offered tremendous opposition to the Bill, and the cost of obtaining the Act was something like £3,000. At that time the output of gas was 18 million cu.ft., with 1,031 consumers and 259 public lamps. The population was then 12,000, and at the present time is slightly less.

The present Works were built in 1862 and are situated on the west side of the town bounded on the east by the River Esk and on the west by the L. & N.E. Railway. The site is a very awkward one, and its formation is such as to allow little room for expansion. There is no cart road to the Works, and transport must be either by river or rail.

At the time of the incorporation of the Company there was only one single-lift holder of about 50,000 cu.ft. capacity. In 1872 a second single-lift holder was built,

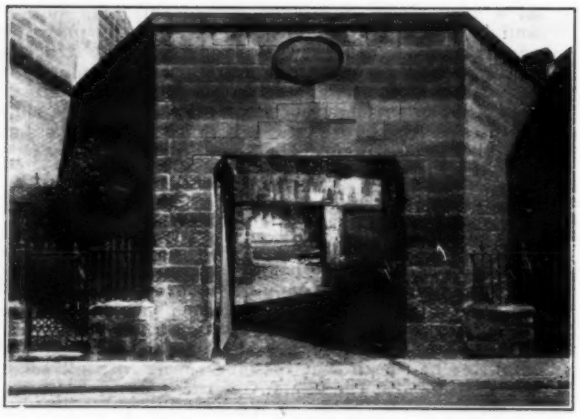


Fig. 1.

90 ft. diameter and 20 ft. deep with a capacity of 114,000 cu.ft. This second holder is of very light construction. A timber framing supports the crown when the holder is landed on the rest blocks. Both the holders are in brick tanks, and the pressure thrown by the holders was not more than 2½ in. The axiom of the Gas Engineer of that date was "Keep down the pressure of the holders and the leakage in the mains."

At this time Whitby was a very busy town. Several hundred men were employed in the jet industry and a considerable quantity of gas was used in the course of the process. In course of time, however, jet ornaments became unfashionable and the trade gradually diminished, and at the present time it is of very small proportions. The loss of revenue to this Company will be understood by the fact that upwards of 500 wet meters were removed from jet shops and eventually sold for scrap. Iron shipbuilding was introduced into Whitby about 1871, and for upwards of thirty years a vast number of men were employed in this important industry. But gradually the industry diminished locally, and the employees migrated to other towns on the north-east coast to find employment.

In 1885 the first exhibition of gas cookers took place, and the cooking load was a welcome addition to the sales of gas. This steadily increased over several years.

In 1892 your President joined the staff of the Whitby Gas Company as Accountant. A local influential gentleman expressed his opinion that it was a very foolish step to take, seeing that gas would soon not be required, as it was almost sure to be supplanted by electricity. *The same gentleman in later years joined the Board of Directors.*

Steady progress was made with the sale and hire of cookers, and it became imperative in order to maintain the pressure during the hours of maximum consumption that steps should be taken to augment the pressure at the Works. A firm of eminent Consulting Engineers were called in, and they recommended that a new gasholder should be erected, part of the retort bench renewed with retorts of greater capacity, and an exhauster installed, together with larger mains laid in various parts of the town.

A Bold Policy.

The next six years were very critical ones in the history of the Company. Maximum dividends had been paid over a long period of years. There was very little money in reserve. The Directors, however, adopted a bold policy; they called up the unpaid capital and exercised the remaining borrowing powers. They decided to promote a Bill in Parliament for increased capital and other powers; but having in view the unfortunate experiences of the Company at the incorporation of the Undertaking, they decided, if possible, to arrange a conference with the Urban District Council in order to ascertain what concessions the Council would require in regard to reduction in the standard price and insertion of a purchase clause. The Directors had several consultations with the Clerk of the Council, the late Mr. W. Seaton Gray (the father of our present Town Clerk, Mr. Vivian Seaton Gray). These resulted in a satisfactory arrangement—namely, a reduction of 10% in the standard price and purchase clause optional for four years. The Bill went before the Committee of the House of Commons as an unopposed measure and received the Royal Assent in July, 1904, the promotion costs being about £600—a great contrast to the opposed Biill of about 30 years previous of £3,000.

In 1906 it was decided to amalgamate the two Offices of Secretary and Manager and the writer was appointed to the Joint Office.

At this time the output of gas per ton of coal carbonized was about 10,500 cu.ft., which was considered very unsatisfactory. It was decided to make a general overhaul of the Works with a view to its improvement. The carbonizing plant consisted of three settings of 7 retorts each, D section, 21 ft. by 15 in., direct fired, and six settings of 5 retorts each, round section, 8 ft. 6 in. long by 15 in. diameter, also direct fired. The gas was taken off from both ends of the retort house. The hydraulic mains of the larger settings were supported on steel joists and those of the smaller settings on cradles supported by the bench itself. An investigation of the smaller settings showed that the dip pipes were of varying lengths and sealed in tar. The whole of the dip pipes were taken out by degrees and sent to a neighbouring foundry, where they were cut to one length with knife edged bottoms. At the same time the valves were taken off the hydraulics and replaced with Weir valves. The bottoms of the hydraulics were drilled and fitted with cocks connected to a tar main running to a tar receiver. A valve was inserted between the large and small settings and the whole of the gas taken off through a retort house governor at one end of the retort house. The tar was run off from the hydraulics once in 24 hours and replaced with liquor. The increased yield of gas was very gratifying, eventually reaching 13,000 cu.ft. per ton of coal carbonized. Unfortunately the expansion of the bench when the retorts were in action repeatedly upset the level of the hydraulics, but this was overcome by sleeves of black iron being inserted into the dip pipes where necessary to equalize the seal. A new bench has since been erected and the hydraulic mains are now carried on steel joists.

Perhaps the greatest disappointment was with regard to the output of the three large settings erected in 1902. A throughput of coal and an output of gas which was estimated to be twice that of the smaller settings never materialized, and the consumption of coke for firing was considerably in excess of what it should have been under reasonable conditions. In 1913 it was decided to convert these settings into regenerators, but as the floor of the cellars would be below the water level in the river at low tide the Directors had considerable misgiving as to the advisability of adopting the recommendation, and it was decided to try one setting only with a view, if satisfactory, to converting the other two later. The retort house walls and the setting itself were underpinned and a cellar excavated. The work in a major part was successful. The pit walls were built of Staffordshire blue bricks backed with concrete made with Pudlo cement. The floor was made of the same material laid on concrete also made of Pudlo cement. Judge, therefore, of my horror on visiting the Works to find about 2 ft. 6 in. of water in the pit. Investigation proved that the water was making its way through a straight joint between the concrete floor of the pit and that of the floor of the setting itself. The contract provided that the floor of the setting should overlap the floor of the pit for a short distance. The contractors were brought and shown the job. their foreman withdrawn, and the work carried out according to contract, and no further trouble was experienced in this direction. This setting proved most satisfactory in the throughput of coal, the

output of gas, and the economy in fuel consumption, and it was decided to alter the two remaining settings accordingly.

Wartime Bombardments.

This work was being carried out when war broke out in the autumn of 1914. Whitby, like our neighbouring towns of Scarborough and Hartlepool, was bombarded by German cruisers on Dec. 16, 1914, and although it did not suffer so severely as they, several lives were lost, including the father to one of my staff at that time, Mr. William Tunmore, now Secretary and Manager of the Bishop Auckland Gas Company. Considerable damage was done in the town, including the bursting of a gas main and destruction to property.

Our Works were very fortunate, for although shells burst all around and shrapnel was found on the gasholders, which fortunately it did not penetrate, little damage was done. Most of the people were in a state of nervous tension. The stokers had taken shelter under the steel plates of the retort house subway during the bombardment, and after it had ceased I met a retort setter employed by a contracting firm leaving the Works in an excited state for the railway station. He strongly objected, as he stated, to being a target for German frightfulness. Unfortunately for him he went to another Works on the east coast, where he was bombed from the air frequently.

The then Chairman of the Company thought it very unwise to proceed with the work, but was persuaded to let the contract go through. The two converted settings proved equally as satisfactory as the first.

used for building a division wall between the retort house and a house to take the Tully plant. The plant was erected and set to work in August, 1920. Considerable difficulty was experienced in the early days of its operation, but after this stage was passed the plant proved itself quite equal to expectations, It was operated by hand and worked until 1930. It had been paid for out of revenue and written off. It was then in a pretty bad state, and the question arose as to whether it was better to carry out very extensive renewals or scrap the plant entirely.

The latter course was adopted, and a new 300,000 cu.ft. per day plant was erected—with a dust interceptor—and operated mechanically. This plant has worked with great success. An eight-hour shift usually produces sufficient gas to fill the relief holder; the plant is then shut down and gas drawn from the relief holder during the next 16 hours. The quality of the gas is much more constant than was the case from the hand-operated machine, the average calorific value, using a steam coal, being about 325 B.Th.U. The maximum is 350 B.Th.U. Our calorific standard is 450 B.Th.U. We have tried oil enrichment with a view to supplying Tully gas only, but it was not altogether satisfactory and much too costly. We usually distribute half and half Tully and coal gas. Consumers' apparatus is adjusted for this mixture, and we have few complaints. The present output per ton of mixed gas is 17,500 cu.ft., or 79 therms per ton of coal carbonized.

When I entered the service of the Company the cost of coal and carriage was very little more than the cost of carriage alone at the present day. Owing to the excessive charge for carriage, it does not pay us to use anything

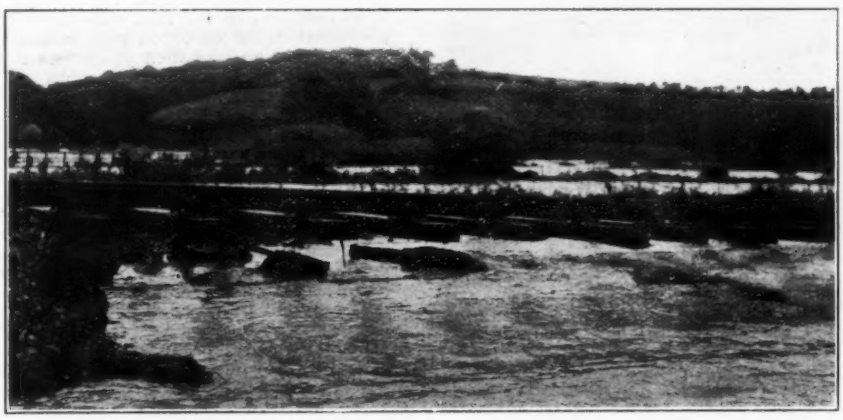


Fig. 2

You will, of course, readily understand that our Works being on a tidal river we are subject to periodical floodings; but a battery of mechanical pumps which can be diverted to deal with flood water normally keeps the cellars clear. In the year 1930 we experienced one of the worst floods in the Esk Valley that had ever been known. Water rose in our cellars up to within 2 or 3 in. of the producer fire bars, and it was only by the use of the forementioned pumps and deluge pumps rushed up hastily from the town that the water was overcome and an explosion of the settings avoided. Portions of two of the railway lines serving the town were washed away and supplies of coal, &c., were cut off from our Works for over a week. Fortunately we had good stocks. Fig. 2 shows a breach in the railway line just above our Works. The bridge at Sleights was carried away, together with the water mains supplying the town, which was on very short rations for a few days.

Coincident with the notice that the water supply would be curtailed, if not cut off altogether after a short period, rumour had it that the gas supply would also be suspended. A notice was therefore inserted in the Company's Showrooms to the effect that as the Gas Undertaking had its own water supply consumers could rest assured there would be no curtailment in the gas supply, and they were encouraged to use gas to the fullest extent possible.

Complete Gasification Plant.

In 1920 it was decided either to convert some of the smaller settings into regenerators or to put in a water gas or a similar plant. A Tully plant was finally adopted. Three of the small settings were pulled down and the bricks

but the best washed double or single nuts. We draw about half our supplies from Yorkshire and half from Durham. The coal has a very low ash content and makes an excellent coke. In gas and coke we have two most excellent smokeless fuels, and it is up to us as gas manufacturers not only to see that our gas is up to standard quality, but coke as well, and in our case the latter must be a good domestic fuel. We think this has proved to be the case by recent analysis and report.

Nov. 4, 1933.

Messrs. Whitby Gas Company,
36 and 37, Flowergate,
Whitby, Yorks.

DEAR SIRS,—

Further to your letter of Oct. 30, regarding the analysis of a sample of your coke. We have now completed same and send herewith the report.

May we say that we find the coke to be of very good quality and its porosity and readiness of combustion such that it is well suited for use in the ordinary open domestic grate. Many gas-works cokes do not usually have the properties necessary to make them into good household cokes; hence the fact that in many towns the use of coke in household grates is not popular.

With regard to the volatile matter in the sample, high-temperature cokes usually have not more than 2%, and frequently only 1%, whereas low-temperature coke usually has 7 to 10%, and is a smokeless fuel even then. *It would therefore be quite correct to regard your coke as a smokeless fuel reasonably near to the much-sought ideal.*

Fig. 3.

Test Report No. A/2892.

Sample submitted by: Messrs. Whitby Gas Company, 36 and 37, Flowergate, Whitby, Yorks.
Description of sample: Coke.
Date received: Oct. 31, 1933.

—	As Received.	As Dried.
Proximate analysis—		
Ash, %	6·01	6·22
Total moisture, %	3·41	..
Volatile matter less moisture, %	5·68	5·88
"Fixed carbon," %	84·90	87·90
Total sulphur, %	1·41	1·46
Heating value—		
Gross calorific value, B.Th.U./lb.	12,988	13,446
,, ,, ,, calories	7,215	7,470
Theoretical evaporative power (lb. of water evaporated from and at 212° F. per lb. of the fuel)	13·39	13·86

REMARKS: The sample was a very good quality coke of moderate hardness and a uniformly open and porous structure. The sample was clean and free from any extraneous foreign matter. The whole of the ash content would therefore arise from the mineral matter associated with the coal prior to carbonization. By comparison with the general run of gas-works coke, this sample has a most satisfactorily low ash content. The moisture content is also satisfactorily low. The volatile matter is rather higher than the average for cokes, but this is a decided advantage as the ready combustibility of the fuel in an open grate is thereby increased. The total sulphur content is moderately good and only a slightly sulphurous odour was noticeable on combustion of the fuel. The calorific value and evaporative power are as high as could be expected, having regard to the percentages of inert matter and the dry ash-free calorific value which is 14,338 B.Th.U. per lb. The colour of the ash residue was reddish-grey, and the indications are that the ash would be of medium refractoriness. The weight of the sample was 15·5 lb.

NOTES: The analysis has been carried out in accordance with the methods laid down in the British Standard Specification No. 496, 1933, which includes the determination of the heating value in the Mahler-Donkin Oxygen Bomb Calorimeter.

For some years past we have suffered very severe competition from broken coke from coke ovens. Last year we put in a coke breaker and the sale of broken coke has been most satisfactory.

Purification.

Up to 1924 the original purifiers were in use. They were built to pass 100,000 cu.ft. in the 24 hours. They consisted of four boxes, 10 ft. square by 3 ft. 6 in. deep, with water lutes, and were operated by a Weck's centre valve. At our maximum output we were producing up to 260,000 cu.ft. in the 24 hours which necessitated constant changing of purifiers with a resultant high cost for labour and difficulty in getting the oxide revivified for further use. They were in a bad state of repair and it had been found necessary a few years previously to encase them in reinforced concrete.

In 1924 it was decided to put in new purifiers provided that a grant could be obtained from the Unemployment Grants Committee towards the cost. It was also decided at the same time to apply for a grant for about 2 miles of new mains. Our application was duly made, but a personal application to the Committee in London was insisted upon. I met the Assistant Secretary to the Committee in London, and the application was declined, owing, it was stated, to the fact that there was very little unemployment in the cast-iron pipe industry.

A suggestion was then put forward by the applicants as to whether a grant could be obtained for steel instead of cast-iron pipes, and the Secretary to the Unemployment Grants Committee stated he had no knowledge of steel gas mains, but suggested that he might obtain an interview for the applicant with a permanent Official of the Board of Trade, at which the matter could be discussed. It was gratifying that the permanent Official was sympathetic. It was also fortunate that some few years before a 6-in. steel main with welded joints had been laid with most satisfactory results. After a long discussion the Official promised to consider an amended application for steel mains, for which, if approved, he would recommend a grant should be given. The question of a grant for purifiers was also discussed on the understanding that he might also make a grant for these, although at the same time he expressed an opinion that considering the age of the purifiers they must be worn out.

We were very gratified a few weeks later to receive a grant for both mains and purifiers, which, although much smaller than had been hoped for, was a considerable help towards the expenditure entailed. Tenders were invited for four luteless purifiers 20 ft. long by 10 ft. wide by 5 ft. deep, with a downward flow. Due to the restricted space available it was necessary to enlarge the purifier house by taking down a partition wall and utilizing a building adjoining which had formerly been a lime shed. Two new purifiers were erected adjoining the old ones and put into use. The contractors undertook to demolish the old purifiers for the value of the metal, and in course of demolition it was found that the condition of the old boxes was very much worse than had been anticipated. The two remaining purifiers were erected in a line with the two previous ones. The working of these has resulted in an enormous saving in the cost of purification. At the time of writing the spent oxide which has been in use for three years is being disposed of with a sulphur content of 55% and a tar content of only 1·5%.

About this time considerable trouble was experienced with the oscillation on the station governor, and as this was in a bad state of repair a new station governor was installed.

Storage.

As previously mentioned, there are three single-lift gasholders, one erected in 1862, a second one in 1872, and a third in 1902. The latter was erected in a steel tank 10 ft. below and 10 ft. above ground. The holder itself being the inner lift with provision for telescoping when necessitated. This holder originally gave 3½ in. pressure. Constant complaints were received from outlying districts of the lack of pressure at the hours of maximum consumption, particularly at dinner time on Sundays. The makers were consulted with a view to increasing the pressure and, with their concurrence, 18 tons of metal was placed in the cup, which increased the pressure thrown to 4½ in.

Our Works, as previously mentioned, are situated on the river side and the wind at times comes down the valley

with hurricane force. During a storm in November, 1922, an S.O.S. was received from the Works late at night during a blizzard of hail and snow that the gasholder erected in 1872 had tilted to a dangerous angle. The inlet and outlet valves were at once closed. The Tully plant for which this was a relief holder was shut down, and we anxiously waited for daylight to reveal the extent of the damage. We found that several of the top rollers were torn away from their bed plates and the holder guides bent and brackets torn from the columns. The makers were communicated with and promised to send a man to examine and advise as to the best course to adopt to get the holder into use again.

Pending his arrival, as many pulley blocks as could be obtained locally were attached to the lattice work. Our own blacksmith made L-shaped hooks out of 3 in. by 1 in. steel with a hole near the top through which the hook of the block was passed, the projection of the hooks being passed under the bottom curb. The chains were tightened up to take the weight of the holder to prevent it tilting further. It was dark before the maker's representative arrived, and it was felt it would be very unwise to attempt any work that night. The chains were further tightened up as far as possible, and as it was a very frosty night we hoped that any contraction caused by the frost would cause the holder to move in an opposite direction, and our hopes were justified. The next morning the holder was found to be on an even keel. It was then emptied and brought to rest on the blocks and the guides were taken off. The position of the brackets was altered and patch plates and new rollers fitted with flanges on both sides—the old rollers had a flange on one side only. As the accident happened at the time of the heaviest winter consumption during the period that elapsed before the repairs were completed it was only possible to work the Tully plant intermittently.

We appeared to be fated with accidents to gasholders, but the most serious was one that occurred in 1931. The holder erected in 1862 had been giving considerable trouble, and a firm of gasholder makers were called in to examine and report on its condition. They reported that the principal damage was on the bottom curb, and it would be necessary to lift the holder out of the tank for the repairs to be effected. This was agreed to, and they proceeded to lift it by the usual method of hooks and screws. The work proceeded satisfactorily until it was about two-thirds

Fig. 4.

out of the water. The man in charge was very nervous and said he would not lift it further on his own responsibility. One of the contractors' officials was sent down to take charge of the work. He said there was nothing to fear and the work proceeded under his supervision. My Assistant and I had left for lunch, and during the lunch hour an S.O.S. was received from the Works that the gasholder had collapsed and fallen back into the tank a complete wreck. Fortunately no personal injury had been sustained by the fourteen men who were working at the screws.

A principal of the firm arrived next day to consult with the Directors as to what was to be done. The firm met us very liberally and undertook to take down the remaining columns and remove the wreckage. It was arranged to replace the holder with a 2-lift spiral-guided holder. The tank was emptied and the wreckage removed and sent away for scrap. The Company's Consulting Engineers were called in and an examination of the tank proved it to be in an excellent condition. A holder was arranged for about twice the capacity of the old one. It was also decided as the inlet and outlet pipes were only 7 in. and 9 in. diameter respectively to put in new inlet and outlet pipes 14 in. in diameter. These were placed in a shaft excavated outside the tank wall and fitted into a steel box inserted under the tank wall itself and so arranged that the vertical inlet and outlet pipes inside the tank were placed as far apart as possible.

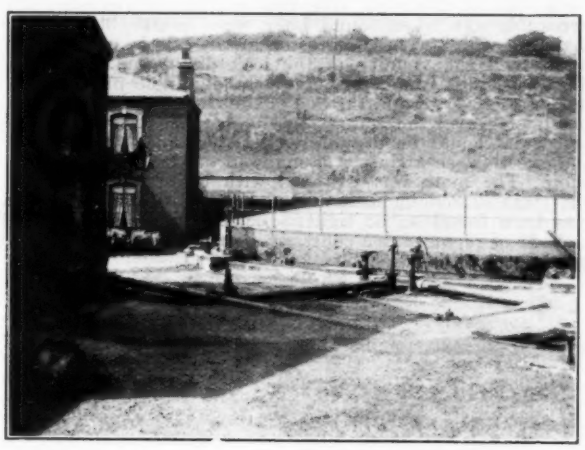


Fig. 5.

The holder was completed and put to work in readiness for the summer visiting season. After this holder had been at work a few weeks it was decided to use the new holder as a relief holder, and in preparation for this extension tee pieces were fitted on the top of the inlet and outlet pipes. Underpressure tees were inserted in the inlet and outlet pipes of the No. 1 holder with the necessary connecting valves and mains to the No. 3 holder. The new holder has proved a very great boon, as we are now able with both lifts in action to give a pressure of 7 in. at the Works as against 4½ in., and has practically disposed of complaints of lack of pressure.

It was decided to overhaul the No. 1 holder, and on the maker's recommendation 6 ft. of water was pumped out of the tank, and an additional manhole cut in the crown of the holder to which was fitted an air lock. A raft was then constructed inside the holder, from which the contractors' men could work and thoroughly inspect its interior. The framework and the interior of the holder itself appeared to be in good condition, but in view of the fact that this holder had been in use over 60 years it was thought desirable to have a section of the crown sheets cut out and sent to be tested for tensile and bending tests. The report was very satisfactory. Small repairs were carried out to the holder itself, and it was put to work again as a relief holder. The report of the Consulting Engineers and contractors justified the expectancy that the No. 1 holder was capable of giving a good many years' service, but, alack! "the best laid schemes of mice and men gang aft agley." In the following spring, after a succession of gales, further trouble was experienced with the holder tilting, and it was then decided to empty both holder and tank and make a thorough inspection both internally and externally.

The tank guides, twenty in number, were each constructed of three sections (see fig. 6) bolted to the tank wall. The bolts had broken off in many places and four or five metal guides were found to have broken away and were laid in the bottom of the tank. Several of the bottom rollers had bolts missing and one or two had been torn away from the holder completely. Two sections of the bottom curb were found to be badly damaged and the interior vertical guides were loose. It was decided to remove all the cast-iron channel tank guides and renew them with steel guides made in one piece, and this was done. New bottom rollers were inserted where necessary and two new sections of the bottom curb fitted. The work was completed in about three months and the holder put into use again. This, we trust, will be our last experience with extensive gasholder repairs. Incidentally, they are now fully insured under a gasholder insurance scheme.

The Distribution System.

As previously explained, our Works are in a very awkward position. Our leading mains are laid for about three-quarters of a mile under the 6 ft. permanent way of the railway line from the Works to Whitby, also from the Works to Ruswarp Village. They consist of a 14 in. reduced to 9 in. with two 9 in. branches. Up to 1926, the main crossing the harbour was 7 in. diameter, and in the year 1898, during a shipping depression, a good many steamers were laid up in the harbour, one of which unfortunately grounded across the gas main and cut off the supply. For a considerable time there was only an intermittent supply to the east side of the town. This was only made possible by continuous pumping of water from the syphons at the harbour side.

In order to locate the leak the main was bagged off at both sides of the river (the two original valves were not accessible and when found later were immovable). The main was filled with compressed air by means of a diver's pump and the vicinity of the leak discovered. A coffer dam was built round it, but as the available pumps were not very powerful and the bed of the river was largely composed of gravel the water came under the piles almost as fast as it could be dealt with. Lead joints were out of the question, so a clasp was made in our own blacksmith's shop. The main was wrapped with rubber sheeting and the clasp placed in position and bolted up; and the main was then found to be tight. Incidentally, although this method of repair was a constant nightmare to the management it remained tight for 28 years.

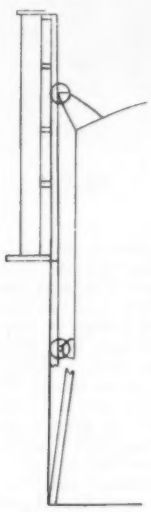


Fig. 6.

In 1926 the number of consumers on the east side of the town had increased sixfold. It was felt that the main should be duplicated, and this was done by laying a 9 in. steel main with long sleeve welded joints. The work was completed without mishap in about six weeks. It was fortunate that this duplication took place, for, on Whit Saturday the following year, the patch on the old main broke away, and owing to flood water and other causes it was some months before it could be repaired. There are now two mains across the river, and this has proved very fortunate by reason of a housing scheme which has developed on the east side of the town. The depth of the main at the west side is about 2 ft. below the bed of the river, increasing to 13 ft. at the syphons on the east side.

Offices, Showrooms, and Administrations.

Our offices and showrooms were situated in one of the principal streets of the town, but the street was very narrow, and with the continual increase of traffic at times became very congested. The building was owned by the Company and was very old, the windows being composed of small panes and not conducive to the display of goods. A gas cooker is generally considered as the ultimate resting place of beef and mutton, but after several sheep and on another occasion a bullock had come into our showrooms through the window we thought the time had arrived either to set back the premises or to move to a fresh site.

Ultimately, after a steam roller had come to rest in the showroom window, the movement was expedited, and we purchased some old property in Flowergate, which was pulled down and our present premises erected. They provide accommodation for offices, showrooms, workshops, and stores, and have a frontage of 27 ft. and a depth of

Fig. 7.

120 ft., with an entrance for goods from a side street. As will be seen from the photographs, the window space allows of a good display of various types of gas apparatus.

While in the old premises we were of opinion that the sale of apparatus had almost reached saturation point. The removal to the new premises, however, has had a remarkable effect in stimulating sales, as will be observed from the accompanying return for the past 4½ years.

—	Cookers.	Fires.	Boilers.	Other Apparatus.	£ s. d.
1931	76	11	43	11	1,170 15 9
1932	73	10	99	30	1,366 17 7
1933	129	41	121	68	2,008 1 6
1934	122	68	89	80	2,154 6 4
1935 (six months only) . . .	92	77	48	56	1,622 5 8

Fig. 8.

The number of consumers at Dec. 31 last was 3,686—viz., 2,114 prepayment and 1,572 ordinary—as against 1,840 in 1906—viz., 560 prepayment and 1,280 ordinary—an increase of 1,846. The output of gas has increased during the same period from 43 million to 67 million cu.ft. per annum.

The frequent display of goods and advertising displays so excellently produced by the various makers of gas apparatus stimulates interest and attracts the public eye. It is generally recognized by our neighbouring shopkeepers that the Gas Company's showrooms and topical displays have largely contributed towards making Flowergate one of the principal shopping streets of the town. The windows are well lighted both internally and externally with high-power lamps fitted with controllers and kept alight until a late hour.

Advertisements.

The Gas Industry owes more than is probably realized to the National Advertising Campaign of the B.C.G.A., which frequent enquiries through that Association from local prospective purchasers constantly testifies. But a National Campaign is not sufficient. To be effective it must be augmented by local advertising. My Directors are quite alive to this fact and are always ready to support propositions for serial advertisements in the local Press. We usually have a series of seasonal advertisements running in our local newspaper, and I should like to take this opportunity of thanking the Editors of that paper for the most excellent reports of this Company's various activities which appear in it from time to time.

In addition to advertising, we keep in close touch with contractors, builders, and prospective purchasers of new properties and encourage local plumbers to make use of our showrooms and allow them a commission on all sales which they effect. Our own fitters too are allowed commissions on all sales effected by them. Advertising is supplemented by an annual exhibition of gas apparatus, together with cookery lectures and baking competitions. Interest in these has been maintained over a series of years, and at our last exhibition over 1,200 people attended the lectures.

We give a full and free maintenance for all classes of gas apparatus sold. Mains and services are laid free for a reasonable prospective consumption, and we have an arrangement with the local builders to carcass new property for fires and other gas points free of charge. This concession, we believe, is greatly appreciated by them and is certainly conducive to sales. We have not so far introduced special tariffs or block rates. For many years we have had in operation a progressive scale of discounts for a quarterly consumption of over 25,000 cu.ft. Recently the scale has been revised and considerably increased and made available to consumers of 10,000 cu.ft. and upwards per quarter.

OLD SCALE OF DISCOUNTS.

The following scale of discounts will be allowed off gas accounts paid during the month in which the account is rendered—viz.:

25,000 and under	50,000 cu.ft.	per quarter,	4d.	per 1,000 cu.ft.	discount	
50,000 ,, ,,	100,000 ,,	,,	5d.	,,	,,	,,
Over	100,000 ,,	,,	6d.	,,	,,	,,

Where consumers have more than one meter, the discount will be allowed off the aggregate consumption.

NEW SCALE OF DISCOUNTS.

The following scale of discounts will be allowed off gas accounts paid on or before the date specified on the demand note:

3d.	per 1,000 cu.ft.	discount on consumption of 10,000 cu.ft. and under 25,000 cu.ft. per quarter.
7d.	,, ,,	discount on consumption above 25,000 cu.ft. and under 50,000 cu.ft. per quarter.
8d.	,, ,,	discount on consumption above 50,000 cu.ft. and under 100,000 cu.ft. per quarter.
9d.	,, ,,	discount on consumption above 100,000 cu.ft. per quarter.

A special discount of 1s. 1d. per 1,000 cu.ft. is allowed off the consumption by gas engines if the amount is paid during the month in which it is rendered.

A special discount of 1s. 8d. per 1,000 cu.ft. is allowed off the consumption by fish fryers. Accounts to be paid weekly.

The Rating of Gas Undertakings.

This may appear to be somewhat irrelevant in an address of this description, but is of tremendous importance to our Industry. In the Paper which I read before your Association ten years ago, the necessity of closely watching assessments was emphasized, and this is even more important to-day than it was at that time. The Ministry of Health have recently issued interesting statistics covering Rates and Rateable Values in the United Kingdom. It is found by comparison with the years 1914 and 1935 that the valuation upon which rates were leviable has increased by approximately 35% and the poundage by 59%. This illustrates very thoroughly the importance of the subject.

It seems manifestly unfair that while Gas Undertakings are among the largest contributors to local rates, they have no part, by vote or otherwise, in the management of the town's affairs. My fifteen years' experience in connection with and participation in local government convinces me that it is very desirable that one or more of the principal officials of a gas undertaking should take a prominent part in local affairs. It is interesting work and of extreme importance. It gives contact with the prominent officials of governing authorities and permits of a close scrutiny of local expenditure. Partially due to this contact my Company's associations with the local authorities and our esteemed neighbour, the Town Clerk, have been always of a very cordial nature.

The meetings of this and kindred Associations and The Institution of Gas Engineers provide material and opportunities to keep abreast of all that is best in the Industry. Recent Papers and discussions have shown that old-time methods will not meet present-day needs. We have got to re-organize and adopt modern methods to meet the ever increasing demands for our product for industrial, commercial, and domestic requirements. We are proud of the Industry that we serve. It has had a great past. . . . It has a great present, and I feel sure a greater future awaits it in the vast fields that are open to us. But this can only be attained by energy and determination and flexibility of charge enabling us to compete with rival industries.

Looking back over 40 years one cannot fail to be greatly impressed and encouraged by the tremendous improvement which has resulted from the researches carried out by the manufacturers with the co-operation of the larger gas undertakings. Gas is by no means a "back number." The lighting switch is a powerful weapon and is proving its value in securing new business and in retaining the lighting of churches, cinemas, and business premises, while this year of Jubilee has shown to the world at large the wonderful effect of floodlighting in the Metropolis and provinces and revealed the intrinsic beauty of many of our public and ancient buildings. It is up to us to use every endeavour to retain the lighting load.

Automatic oven control and the pleasing appearance of the enamelled and coloured cookers and fires have given the death knell to the old-fashioned and sombre looking black cooker and other apparatus, and, if we are to keep pace with our competitors, the black cooker must be banished from our showrooms. Our own policy over several years has been to re-purchase out-of-date apparatus at a liberal price in part payment of modern gas appliances, and we have recently introduced a scheme whereby black cookers on hire are being replaced with enamelled ones at a reasonable rental.

The *Gas Times* of July 20 contained information of interest to all gas undertakings—namely, the launching in this country of a scheme to promote the sale of bottled gas. History repeats itself, and the opening words of this Paper are reiterated in the closing paragraph—viz., Bottled Gas. How far is this development going to affect our Industry? We think it has tremendous possibilities, and it is up to us to give it every encouragement, especially for cooking and heating. There are many potential customers in each of our areas but beyond the reach of our present mains.

I almost envy the younger members in our Industry the many advantages they enjoy in a well organized Technical Press, with its helpful criticism and stimulating outlook and the facilities provided by the Technical Institutions and by the examinations of The Institution of Gas Engineers.

In conclusion, I should like to say that whatever success has been attained by our own Undertaking has been largely due to the foresight and progressive spirit of my present Directors and the splendid co-operation of a loyal and enthusiastic staff. I should also like to thank my assistant and shorthand writer for the valuable help received in the preparation of this Address.

Specification for Portable Photometers

The revision of the British Standard Specification No. 230 for Portable Photometers (Visual Type) that has just been issued was undertaken chiefly at the request of the Street Lighting Committee of the Institution, who required a photometer with a greater degree of accuracy than that provided for in the original issue of the specification. The limits of error in the indications have therefore been reduced from 15 to 10%. The effective range of the photometer has also been modified, and several other small changes have been made in the specification, including the addition of an Appendix in regard to measurements involving large colour differences.

Copies of this revised British Standard Specification (No. 230-1935) may be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, London, S.W. 1, price 2s. 2d. post free.

SOME NOTES ON

Street Lighting Problems and Directional Gas Lighting

by
DEAN CHANDLER
and
A. J. PRESTAGE

Mr. Dean Chandler and Mr. A. J. Prestage, B.Sc., of the South Metropolitan Gas Company, presented this Paper at the Twelfth Annual Meeting of the Association of Public Lighting Engineers in London on Sept. 10.

Our original intention was to devote this Paper exclusively to the subject of directional lighting by gas lamps. It has, however, been indicated that an enlargement of its scope would not be unwelcome. We appreciate this indulgence, since what we propose to say on the subject of directional lighting by gas lamps is not a very long story. We have, therefore, taken this opportunity to comment on one or two matters on the art (or is it the science?) of street illumination, in the hope that a lively discussion may follow, which is, we suppose, one of the chief reasons for your meeting together.

Views of the Experts.

Let us consider quite briefly the present position with regard to street lighting.

This may be gauged to some extent by the recent statements of one or two recognized authorities. In a "Symposium on Illumination," Mr. C. C. Patterson has stated that "the lighting of our streets and highways is passing through a period of evolution, and the best informed are most reluctant to be dogmatic about the form which the most effective street lighting will ultimately take, but we are at least progressing somewhat towards understanding the right principles to follow."

Dr. Pirani (Berlin) recently commented that "only a few years ago it seemed to everybody that illuminating engineering had reached a degree of perfection which could hardly be surpassed. To-day we see that as well in the development of light sources as in the question of adaptations of illumination to different visual tasks we are in the middle of a tumultuous evolution."

"Finality is not reached, nor will it be reached for many years," is the opinion of Mr. Masterman, who thinks that "so long as there is any uncertainty and confusion as to the objects of street lighting, so long will there be various schools of thought regarding the proper type of street lighting to be provided."

Mr. Langlands has suggested that "the scientists should reserve their theories on surface brightness and like postulations until they have means of assessing and measuring their values." Mr. Patterson, however, has replied that this is precisely what the theorists have now achieved; "there are now means of assessing and measuring their values."

We are credibly informed that on the Continent, so far as roads designed specially for fast traffic are concerned, the view is held by some authorities that the best thing to do is to provide only just sufficient light to indicate clearly the boundaries of the road in the direction of its width, the main area of the road being left in comparative darkness. This may be right for the motorist, but what of the pedestrian? In this connection Mr. Walter Garner's comment is interesting. His "experience as a motorist was that the safest road was one in which there was no lighting at all"!

Attention of late has been directed to the recently evolved theory that surface brightness is the all-important element to have in mind, but it would appear that at the recent International Commission on Illumination held in Berlin, this view was not shared by some of the delegates who took part in discussions on street lighting.

We have quoted these views in order to show that considerable divergence of opinion still exists among experts concerning the fundamentals of the street-lighting problem. If basic principles are still in the melting pot—and from the foregoing views one cannot escape that conclusion—then it is obvious the lighting engineer must rely mainly on his own experience and knowledge of the practice of the art of street lighting to get him over the stiles.

It is to the credit of public lighting engineers that, with few exceptions, the lighting of highways and roads of our cities and towns is so satisfactory, and that a relatively high standard of effectiveness and efficiency has been maintained. Street lighting engineers have, in short, proceeded with the task with commendable perseverance and persistence, while the experts have pursued their own course, and have continued their analysis of principles and theories.

The Point of View of the Citizen.

In this country there is a consensus of opinion in favour of illumination of the roads on a scale sufficiently generous to enable the man in the street to get about town in comfort and safety, and any system of lighting which does this will have the approval of the average citizen, who will judge the efficiency or inefficiency of the system by that standard alone. This has been cogently expressed in a Paper on "Public Lighting by Electricity," in which the author said that "if a majority of citizens find that they can see properly with a given installation, then that installation is a good one, even though it may transgress many of the ordinarily accepted principles of the lighting expert; and, conversely, if a majority of the citizens find that they cannot see properly with a given installation, then that installation is a bad one. In other words, the public is the final court of appeal regarding the effectiveness of street lighting." Apropos of this, we may remark that on a recent occasion, when a party of lighting experts were viewing an installation of modern street lighting and expressing many and varied opinions concerning its character and quality, a few onlookers expressed their opinion that the illumination of the road was excellent, the visibility good, and the lighting left nothing to be desired. The doctors continued to differ, and no sort of agreement could be reached. The matter is still being hotly disputed. In the meanwhile, the revision of old street lighting installations has to proceed apace. Their substituton by more satisfactory systems cannot be delayed by differences in regard to the theory of street lighting.

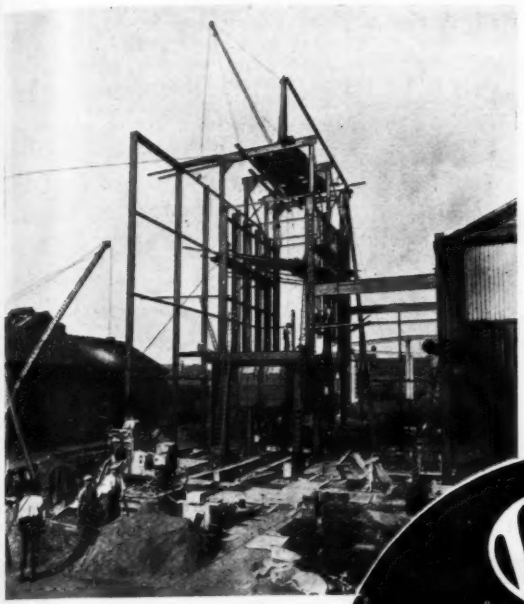
It may be said that laymen are not competent judges of these matters. This is doubtless true, for they are scarcely in a position to analyze the effect of vision by direct illumination, by silhouette effect, and the criteria on which illuminating engineers rely may have little or no meaning for them. Can they, or can they not, see to get about in safety and comfort? That is the one consideration by which they are guided.

It is to be noted that modern street-lighting systems are nowadays often approved or rejected by their visual effectiveness as judged by a committee of inspection for whom demonstration lighting is provided by street lighting contractors. Those who have been present on such occasions know that the lighting of the street is judged by what can be seen and the comfort of *seeing*.

It should be said in defence of the experts that they have certainly introduced a stream of new ideas into what might have become a stagnant condition of rule of thumb practice in the matter of street lighting. We are here prompted to remark that there is one aspect of the problem of lighting which, apparently, has somewhat escaped the attention of scientists, although it is, in fact, one with which they are especially fitted to deal.

Attention has been drawn to the fact that the effect of light falling on the central region of the retina is very different from that experienced when it falls on the outer portion of the retina. Has this any bearing on street lighting in its relation to public safety? Undoubtedly; for peripheral vision of things in motion or at rest is responsible for a very great part of what constitutes the fields of view of both driver and pedestrian in our streets to-day. It appears that this matter of peripheral vision has been somewhat overlooked; indeed, one school would have us believe that, as drivers, our view of a street is narrowly circumscribed and limited to foveal vision of stationary objects seen from a car at rest. There is no motion anywhere; pedestrians and driver alike are still in death even

IN COURSE OF CONSTRUCTION



Construction in progress on an installation of W-D Continuous Verticals for Loughborough Gas Dept.

W-D Carbonising Plants at present in course of construction will, when put into operation, be capable of carbonising a total of over —

2,700,000
TONS OF COAL PER ANNUM

W-D

Carbonising Plants

W-D Continuous and Intermittent Verticals
W-D Becker Ovens

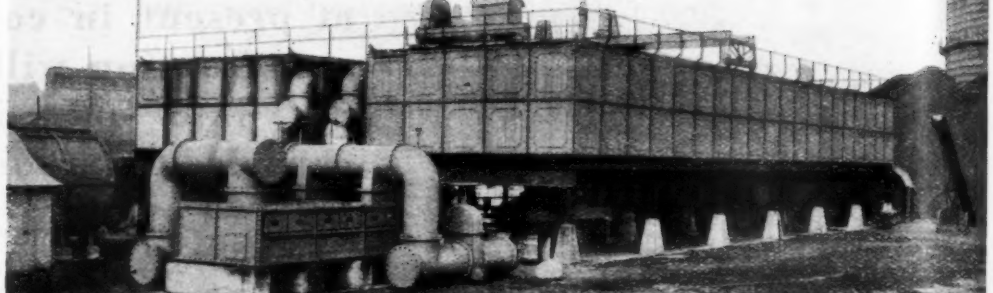
An installation of W-D Continuous Verticals put into service recently for the Exmouth Gas Co.

IN SERVICE "THE WORLD OVER"

W-D Carbonising Plants have been built in 24 countries and in works of all sizes. Their total carbonising capacity is now very nearly ——

14,900,000
TONS PER ANNUM

THE WOODALL-DUCKHAM VERTICAL RETORT AND OVEN CONSTRUCTION CO. (1920) LTD., EBURY & ALLINGTON HOUSES, 136-150 VICTORIA STREET, LONDON, S.W.1
Members of the Society of British Gas Industries
Telegrams: "Retortical, Sowest, London" Telephone: Victoria 8631 (6 lines)



Two Sets of four PURIFIERS, 25 ft. x 25 ft. x 10 ft. deep, on Joist Structure, with Travelling Oxide Handling Plant, erected at the Gasworks, Vancouver, British Columbia.

ROBERT DEMPSTER & SONS LTD.

Wire : "DEMPSTER" ELLAND **ELLAND** 'Phone : ELLAND 261

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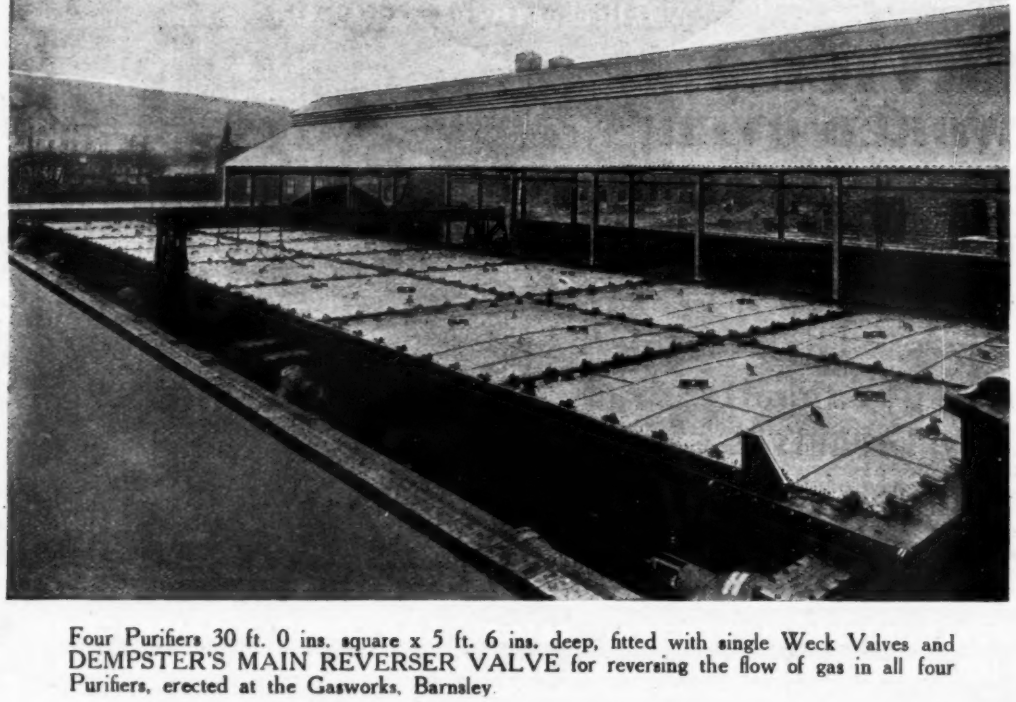


Four Purifiers 30 ft. 0 ins. square x 5 ft. 6 ins. deep, fitted with single Weck Valves and DEMPSTER'S MAIN REVERSER VALVE for reversing the flow of gas in all four Purifiers, erected at the Gasworks, Barnsley.

before the latter has commenced his work! What form of street lighting ensures the greatest degree of safety in a street peopled by living pedestrians, living drivers, living cats, dogs, &c.? That is essentially the problem that awaits solution.

Logically, it would appear that the starting point of discussions on the problems of lighting in relation to road safety is a clear understanding and knowledge of the characteristics of the organ of vision. Is our knowledge concerning this adequate and reliable?

There is obviously a definite relationship between the physiological and psychological functions of seeing which must surely have an important bearing upon street lighting problems.

The physicist, for the most part, concentrates on the measurable factors of the problem and is seldom concerned with the subjective aspects of the matter. The correlation of visual sensations and the physical stimuli which produce them is of importance.

The illumination of a street is one part of the problem—the normal reactions and behaviour of individuals to the system of lighting are not less important.

We should like to advert to yet another matter which does not appear to have received full discussion—namely, the colour of light that should be regarded as ideal in streets. In this connection it is of interest to recall that Dr. Hugo Krüss, of Hamburg, in answer to a questionnaire on a Proposed Standard Specification for Street Lighting, stated that "as regards colour, an approximation to the quality of light yielded by a white cloudy sky should be aimed at."

The Practical Aspect.

Street lighting appliances are now available in such variety that it is possible for the experienced lighting engineer to plan and produce satisfactory street lighting schemes suitable for any outdoor conditions provided no serious financial handicap is imposed; that is the real crux of the problem. The planning of a scheme of street lighting is in reality a straightforward matter, provided sufficient light is allowed and certain well established rules are followed. In the matter of planning, the street lighting engineer's task is not so onerous as might be imagined. The data now available in textbooks and the Technical Press, and the existence of a wide range of lamp and lamp-gear manufacturers' catalogues containing, in detail, information on all types of lighting equipment—total flux, character of the light distribution and the like—provide all the material needed in the planning of street lighting schemes. One other thing is, of course, necessary, practical knowledge of the art of street lighting. If the problem seems to be difficult this probably arises from the fact that all manner of extraneous considerations are apt to be introduced causing it to appear involved, abstruse, and complex. Mr. Patterson has said, "We should not be hypnotized by its complications."

It is probable there would be no problem of public lighting did not considerations of cost enter into the matter. It is to be regretted that reasonable expenditure of public money to provide adequate street illumination has been and, in certain quarters, is still considered to be unnecessary extravagance. This, however, is no new phase of the matter. About half a century ago Mr. William Sugg in a Paper on "Public Lighting" said that, "The public imperatively demanded improved street lighting, but the action of the local authorities in many places had been to decrease the light while the increase in night traffic had gone on from year to year."

It will not be inappropriate to emphasize the fact that the first essential requirement for satisfactory road illumination is the provision of *sufficient luminous flux per unit area of road*. Parsimony in this matter is false economy, and can only lead to disappointment in the matter of satisfactory street lighting.

Next in order of importance is the character of the curves of polar distribution of the light from the source, for it is this which will largely determine the character and quality of the lighting of the road. There are, of course, other factors which enter into the problem, such as the height and distribution of the lamp-posts and their disposition along the road. But knowledge of the character of the polar distribution of the light from the source will enable all other particulars referring to the lighting system to be calculated. We may now summarize the essential requirements for planning a street lighting installation.

Essential Requirements.

(1) A suitable light source of adequate total luminous flux for any given set of conditions;
(2) A light source of low intrinsic brilliance;
(3) The distribution of light from the source to be of a character which will give as far as possible uniform illumination between lamps. This, by some experts, is not considered a desideratum;
(4) The complete light unit (lantern and light source) to be capable of easy maintenance;
(5) Reflecting and refracting attachments to be fool-proof, and as far as possible resistant to unfavourable external conditions.

Directional Lighting.

But to turn to the more practical matters of directional lighting by gas lamps. By reflection, refraction, or diffusion, it is possible to control the direction of the light from any source. The so-called directional devices for street lamps which were introduced just after the war were, for the most part, simple in character. They consisted of pieces of polished metal bent to some suitable shape, or pieces of mirror glass set in a metal frame. These were attached to or placed in the lantern in such a way as to produce the appearance of a greater number of light sources in the lamp than was actually the case. It was a natural development to improve the reflectors by making their surfaces irregular in order to disperse the light to better effect. It is possible that the introduction and subsequent development of the many forms of mirror reflectors which have been so much in evidence in recent years were but the attempts by lamp manufacturers and lighting engineers to improve the lighting of the streets without having to increase the annual expenditure for gas or electricity which the addition of more lamps would have incurred. This may have been the reason why Mr. Skelton introduced in 1878 his "Catoptric" gas lamp which was designed to obtain better lighting of the road by the flat flame gas burner which was then in use. Demonstrating his invention to a number of gas engineers, Mr. Skelton said that "The light radiating upwards is no longer wasted, neither is it concentrated below or close to the lamp, but is otherwise dispersed or concentrated as may be required along the usual dark interval between the lamps."

Simple Re-Direction Attachments.

In this brief review we cannot consider in detail the numerous so-called directive mirror attachments and fittings to street lamps which are to be seen in variety from Land's End to John o' Groats. Of some of these "gadgets" it must be said that they are anything but satisfactory, and in some instances they appear to serve little, if any, useful purpose. They are certainly not ornamental. Mr. Langlands recently referred to "the craze for directional fittings and focussing," and said "that a certain amount of directional lighting is undoubtedly good, but, in every-day practice, the need for adjustment, and careful adjustment at that, to ensure correct focussing, raises difficulties. When a man is sent out on a tower ladder to do his cleaning he may easily send these devices awry, and the last state of that light may be very bad." One does not disparage the use of correctly designed reflecting and refracting devices to redirect some of the light to better advantage. In fact, there is much to be said for their use, but they must be fool-proof in use and capable of withstanding the more or less rough usage of "maintenance." They should also be weatherproof. One might add that the use of directional devices with a view to focussing sharply the light on the so-called B.S.I. test point, is apt to have unfortunate results. In our view, indeed, the adoption of minimum illumination at the darkest point of the street as the main criterion of lighting conditions, has little to commend it.

We now propose to indicate briefly the more recent trend of development of directional lighting by gas lamps and to show that development is now along satisfactory lines.

Some Modern Directional Street Lighting Systems.

The provision of special means for directional lighting to increase mid-span illumination and to reduce the diversity factor has occupied, and is still occupying, the attention of lighting engineers and lamp manufacturers, and, as a result of their co-ordinated effort, considerable progress has been made in the design and construction of lighting units to give almost any desired effect.

For simplicity, we may conveniently classify "directional" gas lamps under the following heads:—

(1) Lamps which embody in their construction specular reflectors of polished metal or silvered glass.
(2) Lamps which are provided with prismatic glass for re-directing the light from the source. The initial difficulties experienced by the breakage of prismatic refractors by heat have been overcome.
(3) Lamps which embody in their construction reflectors and refracting equipment.

(4) Lamps which are equipped with special glass globes which are not prismatic.
(5) Lamps in which the directional device is incorporated in the source itself.

[The authors then described lamps representative of each class, with their respective curves.]

Effect of the Shape of the Mantle on the Distribution of Luminous Energy.

We now propose to describe in some detail a recent development of the system of high-pressure gas lighting, particularly with regard to a more scientific direction of the light from the source. It is generally known, at least to those connected with the Gas Industry, that the South Metropolitan Gas Company has in recent years favoured the use of so-called high-pressure gas lamps for the illumination of the main roads of South London.

Experience with the system (which is now in use over forty-two miles of main roads) indicated that some of the light from the cylindrical mantle could be redirected with considerable advantage to the illumination of the road. A natural and logical development is to modify the existing shape of the light source, so that a greater proportion of the light should be in the desired direction.

A New Form of Gas Lamp.

In the design of the lamps to be described (to which the distinctive name "Supervia" has been attached) it has been borne in mind that the simplest method of obtaining a naturally asymmetrical directional and economical effect from a light source is to shape the source in such a manner that the maximum luminous area is presented towards the region requiring the maximum intensity of illumination. It is clear that, in order to use effectively the light from a single source for road illumination, the maximum area of the mantle must face up and down the road, while the minimum is presented towards the sides.

For a single source of light to give uniform road-surface illumination when centrally disposed over a straight road, it can easily be shown that the polar curve of the distribution in a vertical plane parallel to the road is represented by the equation

$$I = Eh^2 \sec.^3 \theta$$

where: I = Candle power at angle θ with vertical.
h = Height of source above road.
E = Horizontal illumination on road.

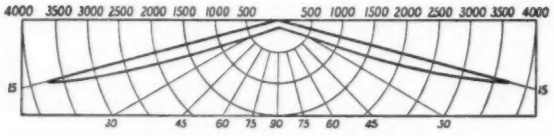


Fig. 1.—Calculated Distribution Curve to give a uniform horizontal illumination of 0·16 foot-candle with source suspended 20 ft. above road.

It is evident from the graph of this equation, shown in fig. 1, that, owing to the rapid change of intensity with angle, the adjustment and disposition of a system of sources with this characteristic would be so critical that the slightest inaccuracy would produce a disastrous result on the uniformity of illumination. The theoretically best distribution must, therefore, be tempered with the demands of practice. A compromise has been effected in these high and low pressure lamps of the new type, in the design of which are incorporated efficient, directional illuminating characteristics with the minimum of maintenance difficulties.

The "Supervia" High-Pressure Lamp.

The fundamental principle stated above has been made the basis for the lamp design, a design which has necessitated the production of a special rectangular mantle which is used as the asymmetrical light source. In the larger H.P. "Supervia" lamp the rectangular mantle, the fabric of which is supported by a nichrome wire frame, is held just below the superheater, which is made of a special heat-resisting alloy.

The mantle is clamped to the burner by two wing nuts and is heated by the flame issuing from the rectangular nozzle of dimensions $\frac{1}{16}$ in. by 4 in. The mantle dimensions are such that the fabric occupies the hottest part of the highly aerated flame, thus ensuring maximum luminous efficiency. While the directional effect of the bare mantle is a great advance on that afforded by the conventional, cylindrical mantle, the desired distribution is not fully obtained. A refractor dish is used to accomplish the final re-direction. This is supported by a chromium-plated frame, which positively ensures the correct position of the dish relative to the mantle. The complete burner is surrounded by a clear glass globe, which protects the unit from the weather.

For centrally suspended lamps the refractor is of symmetrical design and the lamp is placed with the mantle presenting its maximum area up and down the road. In this position the light distribution in a vertical plane parallel to the road-length is as shown in fig. 2, with the

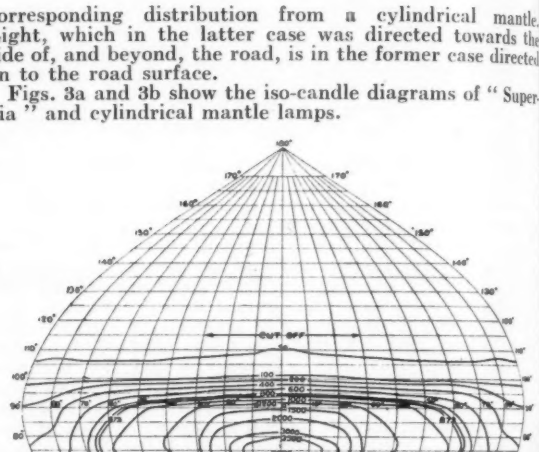


Fig. 2.—Distribution Curve (full) of "Supervia" H.P. Lamp. (Gas Rate 0·107 therm/hour.) Also Distribution Curve of Non-Directional H.P. Lamp (broken). (Gas Rate 0·121 therm/hour).

corresponding distribution from a cylindrical mantle. Light, which in the latter case was directed towards the side of, and beyond, the road, is in the former case directed on to the road surface.

Figs. 3a and 3b show the iso-candle diagrams of "Supervia" and cylindrical mantle lamps.

Fig. 3a.—Isocandle diagram of "Supervia" No. 1 H.P. Lamp. (Gas Rate 0·107 therm/hour.)

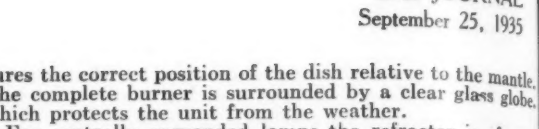


Fig. 3b.—Isocandle diagram of Non-Directional H.P. Lamp. (Gas Rate 0·121 therm/hour.)

Road Surface Test Results with High-Pressure Lamps.

In figs. 4a and 4b are given results of tests of horizontal illumination on the road in South Street, Greenwich, with (a) H.P. "Supervia" lamps, (b) H.P. cylindrical mantle lamps. In each system the lamps are mounted in

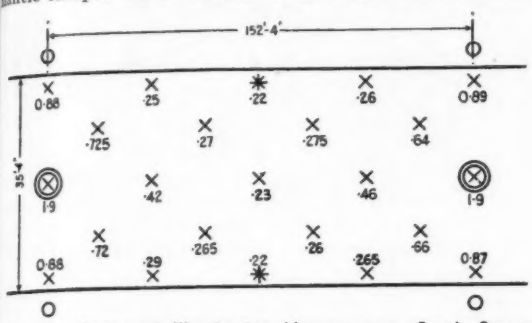


Fig. 4a.—Horizontal Illumination Measurements South Street, Greenwich, lighted by "Supervia" No. 1 H.P. Lamps. (Diversity Coefficient 8·6 : 1.)

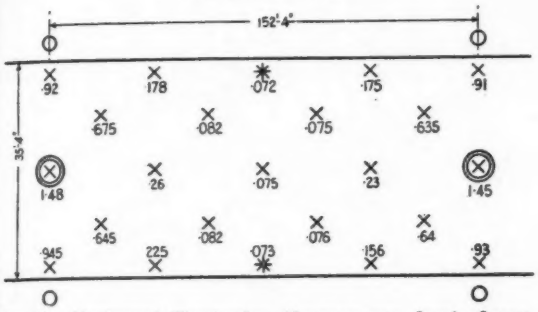


Fig. 4b.—Horizontal Illumination Measurements South Street, Greenwich, lighted by Non-Directional H.P. Lamps. (Diversity Coefficient 20·5 : 1.)

identical positions, and the rates of gas supply are the same. The diversity factor in the case of (a) was 8·6, and in (b) it was 20·5. The use of the new lamps effected a marked improvement in the uniformity of the illumination, which is clearly depicted by the widening of the contour lines of equal intensity in the corresponding isolux diagrams, figs. 5a and 5b. It will also be seen that the mini-

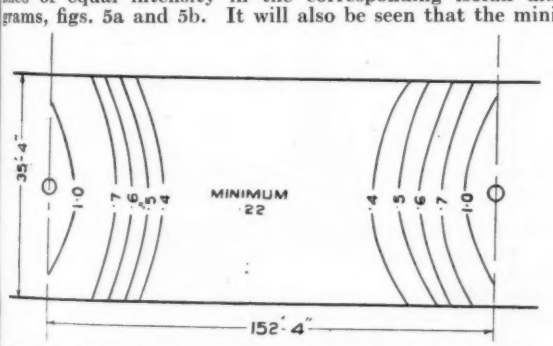


Fig. 5a.—Isolux Curves of Horizontal Illumination South Street, Greenwich, lighted by "Supervia" No. 1 H.P. Lamps. (Mounting Height 20 ft.)

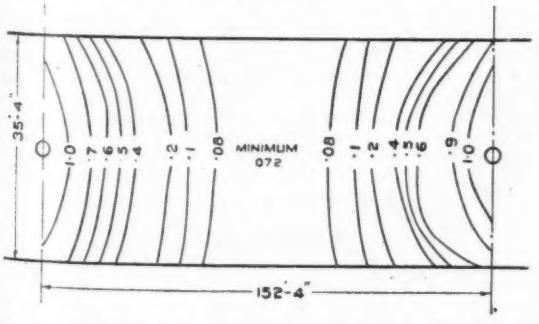


Fig. 5b.—Isolux lines of Horizontal Illumination South Street, Greenwich, lighted by Non-Directional H.P. Lamps. (Mounting Height 20 ft.)

mum intensity of illumination is increased threefold by the redistribution. Sinusoidal projections of the intensity distribution and the road boundaries show that there is a 35% increase in the quantity of light falling on the road surface in the case of the new type of lamp as compared with that from lamps using the cylindrical mantle.

The Low-Pressure Lamp.

The low-pressure lamp has been developed on the same principle of maximum luminous surface to be presented to the direction requiring maximum intensity. The rectangular mantle in these lamps is heated by the flame issuing from a rectangular slot in a refractory nozzle. Refracting dishes are used with the single mantle type lamps in order to obtain the required distribution.

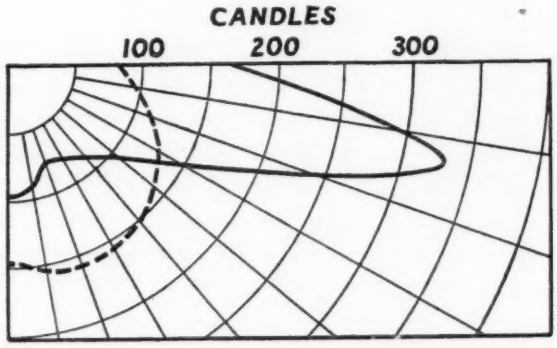


Fig. 6.—"Supervia" "G" type L.P. Lamp with strip Mantle. (Gas Rate 0·021 therm/hour.) Distribution Curves (full) in comparison with Non-Directional Lamp of similar consumption (broken).

Road Surface Test Results with Low-Pressure Lamps.

Fig. 6 shows the axial distribution curve of the "G" type of L.P. lamp and the corresponding curve of a 2-lt. No. 2 non-directional lamp.

Figs. 7a and 7b show actual horizontal illumination measurements made in a residential road lit by (a) the

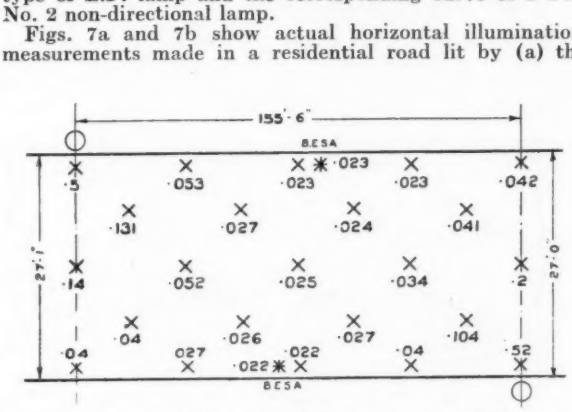


Fig. 7a.—Horizontal Illumination Measurements of road lighted by "Supervia" "G" type L.P. Lamps. (Diversity Coefficient 23·6 : 1.)

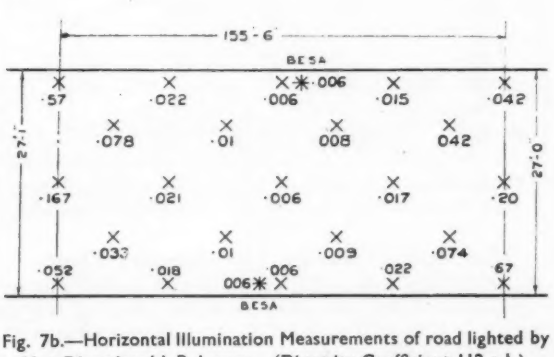


Fig. 7b.—Horizontal Illumination Measurements of road lighted by Non-Directional L.P. Lamps. (Diversity Coefficient 112 : 1.)

"G" "Supervia" lamps and (b) by the non-directional lamps. The spacing and height in the two tests shown were identical and the gas rate of each type of lamp was

the same. The advantageous redistribution of the light is evident from the isolux diagrams, figs. 8a and 8b.

A more uniform illumination is obtained with the "Supervia" lighting, as is shown by its diversity factor of 22·6, as compared with 112 obtained with the non-directional lamp. The minimum has been increased nearly fourfold, thus bringing the unclassified illumination into class "G."

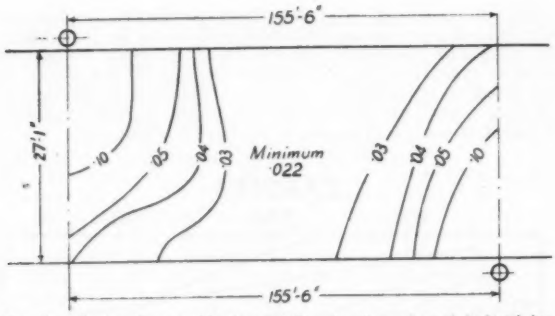


Fig. 8a.—Isolux lines of Ho izontal Illumination of road lighted by "Supervia" "G" type L.P. Lamps. (Mounting Height 15 ft.)

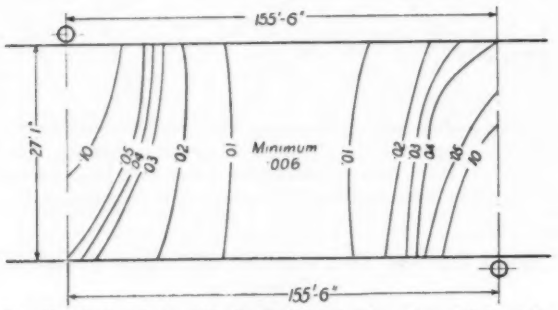


Fig. 8b.—Isolux lines of Horizontal Illumination of road lighted by Non-Directional L.P. Lamps. (Mounting Height 15 ft.)

With side-suspended lamps, as used in this case, a non-axial, asymmetric refractor is used which has the effect of displacing the symmetrical distribution *en bloc* 15° towards the road, as shown in figs. 9a and 9b.

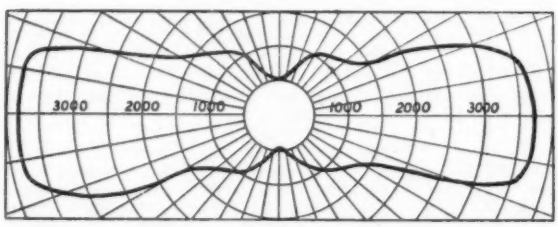


Fig. 9a.—Azimuthal Distribution Curve 15° below horizontal effected by an Axial Dish Refractor with a rectangular Mantle.

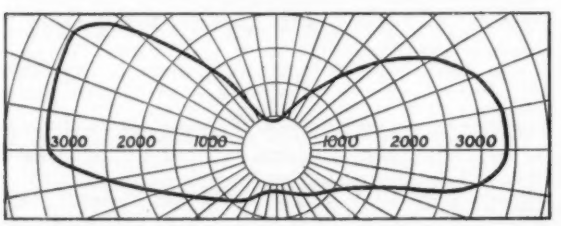


Fig. 9b.—Azimuthal Distribution Curve 15° below horizontal effected by a Non-Axial Dish Refractor with a rectangular Mantle.

The Multiple-Mantle Low-Pressure Lamp.

For thoroughfares requiring more brilliant illumination by means of L.P. gas, more powerful units of the new lamps, which possess equally effective illuminating properties, are available.

Fig. 10 gives the axial distribution curve of a multiple-mantle "Supervia" "E" type lamp, and the corresponding curve of an 8-lt. No. 2 non-directional lamp. For comparison of actual performance of the lamps, test measurements on a main road lit by these lamps, mounted at the same height on the same poles and consuming gas at the same rate, are given in detail in figs. 11a and 11b. The directional lamp results in (a) show the diversity factor by this lighting to be 4·1, while in the case of the non-directional lamps (b) this factor is 31. It will be seen that the minimum intensity of illumination has been increased nearly four times by the substitution of the directional lamps.

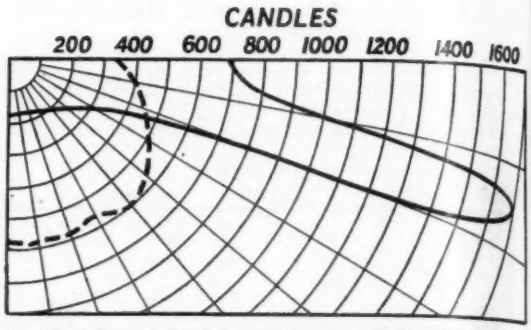


Fig. 10.—"Supervia" "E" type L.P. Lamp with Distribution Curve (full). (Gas Rate 0·111 therm/hour) Also Distribution Curve (broken) for Non-Directional Lamp. (Gas Rate 0·112 therm/hour.)

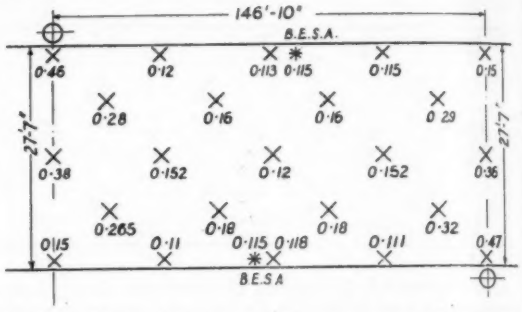


Fig. 11a.—Horizontal Illumination Measurement of road lighted by "Supervia" "E" type L.P. Lamps. (Diversity Coefficient 4·1 : 1.)

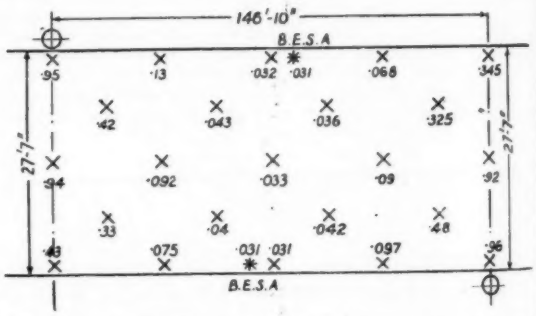


Fig. 11b.—Horizontal Illumination Measurements of road lighted by Non-Directional L.P. Lamps. (Diversity Coefficient 31 : 1.)

The uniformity of road illumination, as illustrated, bears out the photometric test results.

It has been remembered throughout the designing of these lamps that, important as is the attainment of good directional characteristics, their correct application is equally vital. This is a condition that can only be ensured by making the units as simple as possible, with adjustments which are not ultra-sensitive. In the hands of the maintenance staff the practicability of the lamps has been proved; indeed they call for no more maintenance than that required by lamps of a simple non-directional type.

We wish to express our thanks to Dr. Carpenter, President of the South Metropolitan Gas Company, for facilities granted for the preparation of this Paper, and to colleagues, more particularly Dr. J. S. G. Thomas and Mr. J. B. Carne, B.Sc., for their valuable assistance in collecting the necessary material.

Discussion.

Dr. S. English (London), remarking that this Paper extended and amplified, so far as gas street lighting was concerned, the Paper which he had read at Aberdeen last year, said that perhaps another reason why this Paper was suggested was that somebody with a sense of humour would rather like to hear him eat the words he used at Aberdeen with regard to the possibility of making prismatic heat resisting glass sufficiently durable to withstand high-pressure gas. At Aberdeen he had

The Parkinson "Minette" is available in a variety of designs, giving a wide choice of neat, compact models ideal for small houses, flats and bungalows. Furthermore Gas Engineers will find the alternative range of hot plates a valuable aid in satisfying varying requirements. The choice of hot plates for the No. 1212 Models is as follows:—

1. **One Boiling and one Grill burner.**
2. **Two Boiling burners.**
3. **One Boiling burner and combined Grill and Boiling burner.**

The No. 1112 with plate rack is equipped with two boiling and one grill burner.
The "AJUSTO" Oven Heat Control can be supplied with any Model.

PARKINSON

No. 1112
WITH PLATE-RACK

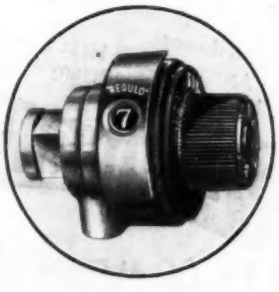
No. 1212
WITH DRAINING BOARD
WHICH ACTS AS A SPLASH
PLATE WHEN RAISED

AVAILABLE IN A VARIETY OF MODELS *for the* SMALL KITCHEN

THE PARKINSON STOVE COMPANY LTD. BIRMINGHAM
London Showrooms: Terminal House, Grosvenor Gardens, S.W.1
MEMBER OF THE SOCIETY OF BRITISH GAS INDUSTRIES

¶ The success of the "New World" Cooker has made "any time cooker time." A comparison of sales graphs to-day with those of even a few years ago shows the "peaks" flattened and the hollows raised satisfactorily. A "New World" in the showroom means steadily increasing business all over your district—for everybody knows its wonderful story!

The REGULO



Radiation

The

FAMILIAR FORMULA

"New World for increasing gas cooker sales!"

NOTHING succeeds like — the "New World" Cooker! . . . Sales are helped by two substantial advantages: one is that the "New World" features are familiar to women throughout the country, by reason of heavy and constant advertising — the other, and most important, is that the "New World" lives up to its reputation in every respect.

It is this personal recommendation that increases business so consistently and, best of all, steadily builds goodwill for Gas at the same time.

Gas cooking to-day stands pre-eminent — and few would question this fact—the "New World" with its unfailing "Regulo" oven-heat control and other revolutionary features, has borne a giant's part in putting and keeping it there.

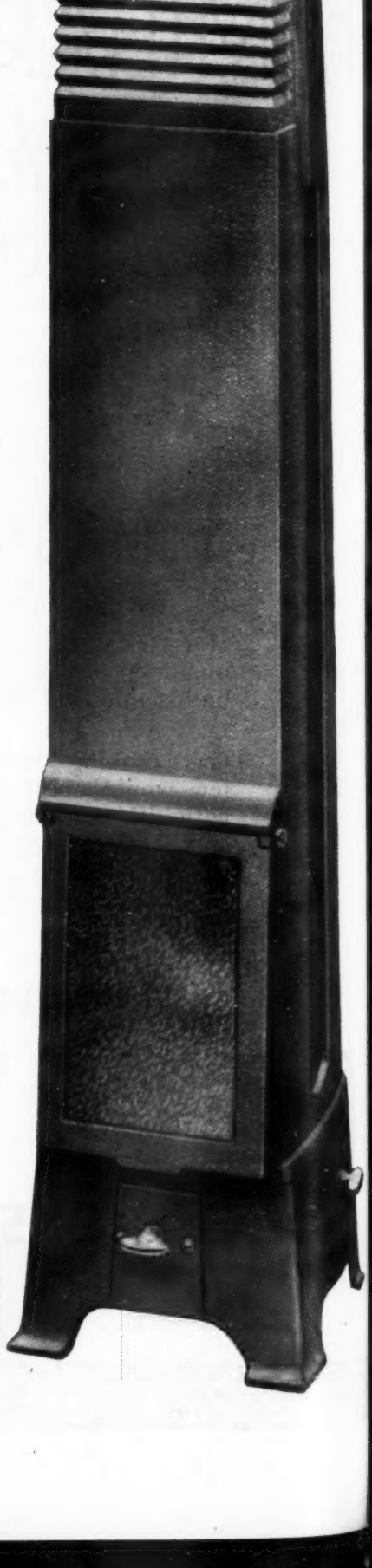
REGULO-CONTROLLED

NEW WORLD

COOKERS AND RANGES

The Cannon "Beacon" Radiator represents the high-water mark in gas radiator design and practice. In appearance it is distinctively modern, yet will harmonize with any scheme of architecture or decoration. Its heating qualities are exceptional. No heat whatever is wasted. No flue connection is required. The "Beacon" may be obtained in one, two, or three column units (with or without boiling burner) and in two lengths of column.

Sole Manufacturers: Cannon Iron Foundries, Ltd., Deepfields, Nr. Bilston, Staffs. London Office and Showrooms: Thames House, Westminster, S.W. 1.



CANNON

stated that to have obtained glass sufficiently heat resisting to stand up to ordinary pressure gas was an achievement and that he was rather doubtful about going any further, at any rate, for the time being. It was, therefore, a matter of some surprise to him when Mr. Chandler had showed him his new high-pressure lamp glass which was standing up without any trouble at all.

Continuing, Dr. English congratulated the authors upon the remarkable advance that had been made in gas street lighting by the adoption of the peculiarly shaped strip mantle. It would be interesting to know in that connection whether that particular shape gave better street lighting distribution than the ordinary inverted cylindrical mantle; it seemed to him quite likely that that strip mantle would probably give a somewhat better distribution than a number of small mantles arranged in linear formation, but he would like to know whether the strip mantle gave a sufficiently improved distribution to justify its use, having in mind that the strip mantle was probably more fragile than the small independent mantles. Could Mr. Chandler also say whether a statement made in one of the other Papers that this type of lamp gave more glare was accurate.

Mr. C. Harper (Assistant Borough Engineer, Barking), referring to the comment in the Paper on peripheral vision, suggested that this did not tell the whole story because it did not make any reference to the extreme rapidity with which the human eye could change its direction of vision, and, further, the comments in the Paper on this subject left out another important factor, namely, the question of retention of visual impression. According to what the authors had said, if one were looking at a postcard, the only portion truly visible would be that of the size of a sixpence in the middle and the rest would be a blur, but, of course, that was not so because owing to the rapidity of the movement of the eye the whole area of the postcard was covered, and of course everybody knew that their impression of the whole postcard was distinctly clear and not as would be implied from the Paper.

Mr. C. H. Woodward (Bournemouth) remarked that in the "Supervia" lamp, all eggs were in one basket. With a number of small mantles, if one mantle happened to go, only a small percentage of the total light was lost, whereas in the case of the "Supervia" lamp there was a total loss of light if the one mantle went. Therefore, he asked for the authors' views on the question of reliability of the new lamp from this point of view.

Peripheral and Foveal Vision.

Speaking from the point of view of the motorist and the question of foveal and peripheral vision, Mr. Woodward said the angle of actual vision was in the region of 160°. Without enlarging upon the question of blurring outside the foveal area, he wished to draw the attention of motorists to a particular matter. When meeting cross-roads there was the choice of two things, either look to the left first and then the right, or *vice versa*, but personally he preferred, in taking cross-roads, to go slowly, and instead of looking either to the right or the left to make use of marginal vision to act as a scout to warn him which way actually to look. That was really the whole process of vision both by day and by night, although we might not be conscious of it. The area of foveal vision was so small that unconsciously we made use of peripheral vision as a form of scout which was sent out in order to give a warning which way to direct the acute vision.

Commenting upon the recommendation in the Highway Code that drivers should drive within the capacity of their braking accommodation, Mr. Woodward expressed the hope that he would eventually find another recommendation in the Highway Code that a driver should not drive beyond the accommodation of visibility. There were many occasions in which a driver ran into a spot where there was practically no visibility, and speed should be reduced considerably. As a matter of fact, in his own case there had been times when he had been very thankful he was going slowly in such circumstances because there had been cyclists in his way whom he had not seen.

Mr. G. H. Wilson (Research Laboratories, General Electric Company) said he himself had inspected a number of installations using the new gas units described in the Paper, and had found many of them to be excellent. From the iso-foot candle diagrams given in the Paper, however, it was not possible to judge of the excellence of these installations, but, as a layman with a certain amount of common sense and some technical knowledge and endeavouring to judge these installations from the layman's point of view, he most definitely had found many of them excellent indeed. At the same time, he thought their excellence was not due to compliance with the essential requirement number three given in the Paper which stated that the units should give as far as possible uniform illumination between the lamps. The authors also stated that the provision of special means for directing the lighting to increase mid-span illumination and to reduce diversity factor was occupying the attention of lighting engineers, and in another part of the Paper stated that the use of directional devices with a view to focussing sharply the light on the so-called B.S.I. test point was apt to have unfortunate results. He would like to have some explanation from the authors why doing the one thing was apt to have unfortunate results, and doing the other, which seemed very similar, was an essential requirement. Personally, he did not think the authors had carried their analysis quite to the final conclusion. He believed that an ordinary observer did not want to see uniform illumination but what was commonly called uniform lighting, or, expressing it more technically, uniform brightness of the area that was seen. Perhaps that was what the authors meant, although they did not express it in that way in the Paper. He felt convinced that if the authors were able to obtain the theoretical curve shown in fig. 1 with a lantern which was erected at normal heights and normal spacings they would produce an installation which would satisfy nobody.

Finally, Mr. Wilson put in a plea for some standard convention with regard to the viewpoint from which photographs of street lighting were taken, and suggested that the camera should be placed about 10 ft. from the near-side of the curb and about 5 ft. high, which, he said, represented the normal position of the driver of a vehicle.

Essential Requirements for Lighting Installations.

Mr. J. I. Bernard (British Electrical Development Association), while agreeing with the authors' first essential requirement and stating that unless there was sufficient total flux from the light sources it would be impossible to get satisfactory illumination no matter what gadgets or arrangements were in the lantern, referred to the second essential requirement of low intrinsic brilliance and said this depended on whether the source was screened or not. When there was a refractor between the source and the observer then surely it was the beam candle power which determined the glare and, even when there was no refractor, it must be borne in mind that in the ordinary view in a busy street there were probably many other light sources of high intrinsic brilliance over which the public lighting engineer had no control. The third requirement as to uniform illumination was, as the authors stated, open to dispute, and what really mattered, as Mr. Wilson had said, was that there should be uniform brightness on the road surface and pavement because only in that way could uniform visibility be obtained. With regard to the fourth and fifth requirements relating to ease of maintenance of lanterns and light sources, there might be some doubts as to the possibility of maintaining the flat mantle in good condition easily.

Finally, Mr. Bernard agreed with the authors that cost was the crux of the whole question of street lighting and mentioned that in America where during the depression in recent years some towns had decided to reduce the expenditure on public lighting, statistics had shown that the saving so made was far more than counter-balanced by the increased traffic accidents which had occurred due to the reduced lighting. In other words, the community had to pay more in accident risks than had been saved in the reduced cost of street lighing. This was a very important matter, having regard to the increased traffic risks now existing in this country, and should have a great influence upon local authorities in their street lighting policy.

Mr. F. C. Smith (Research Laboratories, The Gas Light and Coke Company) spoke of the immense amount of work which the authors and their colleagues had put into the production of the new lamp and of the enormous amount of research that had been involved in getting the physics of the burner right. Commenting on what had been said as to expressing illumination to the second place of decimals, Mr. Smith remarked that although this might be foolish generally speaking, it had to be remembered that the second place of decimals might represent 10% and sometimes contracts turned on a difference of 10%. Continuing, he said he would not enter into the controversies of road brightness and road illumination; there were people who believed road brightness was the right thing and those who believed illumination was the right thing, but a point which the authors had not mentioned was that the "Supervia" lamp enabled both schools of thought to be satisfied because by a simple movement of the refractor it was possible to throw a beam up to about 10° below the horizontal, and it was also possible to get an intensity of 75 or 70, so that if the municipal engineer had a road surface which demanded road brightness he could have it. On the other hand, if he wished to pass the B.S.I. test point the lamp also enabled this to be done. Its flexibility was a real advantage at a time when we were a little uncertain as to which way we were likely to move. A further real advantage of this lamp was the ability to reduce the pressure to lower the intensity, and of course effect a corresponding saving. There were many installations in which a number of lamps were put out at midnight which of course completely altered the lighting plan of the illuminating engineer, but the ability with the "Supervia" lamp to reduce the candle power by a reduction of pressure and to keep all the lamps alight was an immense advantage. From the point of view of the Gas Industry he regarded this lamp as making lighting history.

Mr. J. F. Colquhoun (Sheffield) said he could not quite understand the statement in the Paper, "In our view, indeed, the adoption of minimum illumination at the darkest point of the street as the main criterion of lighting conditions, has little to commend it." That was hardly a fair statement because the test point illumination had no right to be termed the main consideration. If any of the other regulations of the specification such as mounting height, spacing, &c., were broken, then they departed from the specification just as much as if they had fallen short of any desired illumination of the test point. Mr. Colquhoun also pointed out that in fig. 5a, the minimum illumination was 0·22, and this was raised from 0·072 in fig. 5b. Would the authors say whether the disability by so raising the minimum illumination had or had not been increased? If it had not been increased, he would like to know why the authors went to the trouble of raising the minimum illumination. The point was that on the one hand the authors criticized minimum illumination and on the other hand exercised considerable ingenuity in raising it.

Mr. D. G. Sandeman (Edinburgh) remarked that it appeared the cost of running the new lamp would compare very favourably with anything electrical; indeed, he thought it would beat

electricity and it was a lamp in which great interest would have to be taken in the future. A point of criticism about it, however, was that from the curves it gave only about 2,000 c.p. at the horizontal and the maximum brightness at 15°. Was this 15° arrived at from theoretical considerations or had the authors found that this gave the best results? In conclusion, Mr. Sandeman mentioned the case of a road in Edinburgh, which was lighted on one side with electric lamps spaced at a distance of 60 yds., the road being about 120 ft. wide. Highly directive fittings were used which were capable of adjustment. According to the makers' instructions the beams were adjusted to 15° below the horizontal, but it was found by raising the beam to about 5° below the horizontal very much improved results were obtained, and the Committee had refused to sanction any alteration in the installation having seen this improved result.

Mr. J. M. WALDRAN (Research Laboratories, General Electric Company), commenting on the different distributions shown in the curves in the Paper, said these could be divided into different types, and no doubt the authors had arrived at some conclusions as to which type gave the better results. Mr. Sandeman had just given an example of what could be done by an apparently small change in distribution, and he himself had been concerned with an installation in which by raising the peak of distribution from 15° below the horizontal to 5° below the horizontal, it had been possible to halve the illumination and double the brightness on the road.

The Authors' Reply.

Mr. CHANDLER, replying first to the point raised by Dr. English as to the comparison between the strip mantle and multiple mantles in linear form, said a comparison had been made of the "Supervia" lamp and a lamp with four mantles in linear formation. The energy input in both cases was precisely the same and the area of the fabric was identical. A photometric test showed that the increase in light from the strip mantle was 60% as compared with the other type. As to the brightness of the source of light, in recent years this matter has been dealt with almost *ad nauseam*, and the discussion, like the procession caterpillar, has proceeded pretty much in a circle. Dr. English has been prompted to refer to this matter by a comment in a Paper to be given this afternoon, in which reference is made to the new gas lighting unit. In this connection it is interesting to note that apparently provision is now being made whereby the "demand" for such brightness "can be readily met" by the electrical gaseous discharge unit. At all events, he claimed that it was possible to stare at one of the "Supervia" lamps for ten minutes with the beam 15° below the horizontal, and then to drop a coin and be able to see it quite easily.

In reply to Mr. Harper on the question of vision, Mr. Chandler said this question had been raised because there was such a thing known as the fixation of vision. It was a remarkable thing to what extent the vision of the eye varied with human beings. He had been told that 40% of people suffered from a disability in this regard; for example, when driving a car the vision generally was fixed at some point in front and did not wander all over the place, and that had been very strongly emphasized to him in connection with some observations that were being carried out when the driver of the vehicle was asked to drive past an inanimate object, but before they had gone very far they found themselves running into an Alsatian dog 15 yds. in front, which they had not seen, because it was out of the line of vision in regard to the object they had been looking at. That was one of the points they had in mind in speaking of peripheral vision. With regard to the strength of mantles, experience had shown that the strip mantle was stronger than the multiple mantles owing to the method of attachment. So far, at any rate, there had been no trouble from this cause.

The question of the projection of the beam on to the test point, mentioned by Mr. Wilson, could be argued about in an interminable manner. He agreed with Mr. Wilson that some standard should be fixed for photographic work in connection with public lighting because of the extraordinary effects that could be produced in the absence of any standard.

As to curves 5a and 5b, he assured Mr. Colquhoun that the illumination in 5a was a very large improvement as compared with 5b.

Replying to Mr. Sandeman, it was stated that the maximum beam of 15° below the horizontal had been decided upon as in all the determinations and observations recorded in the Paper there was a spacing distance of 150 ft., and a height of 22 ft., and 15° had been determined as the correct angle for the distribution of light in the main beam.

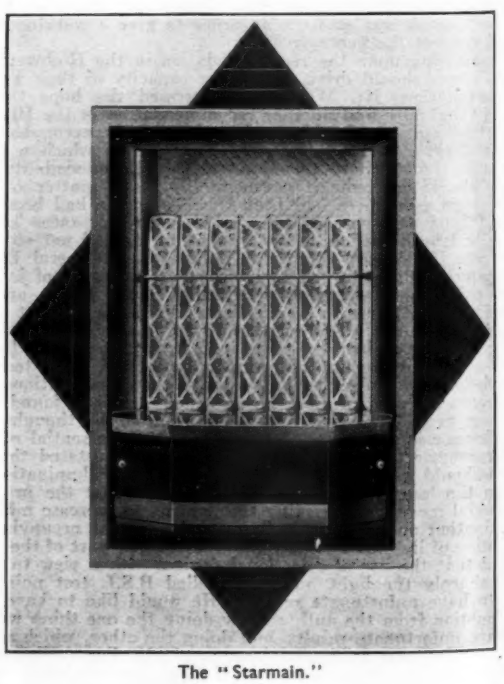
While thanking Mr. Smith for his kind remarks, Mr. Chandler said he was bound to say in reply that the work being done at Watson House by Mr. Smith and his colleagues was such as would lead the Gas Industry into wider fields in the future. The two large London gas companies were working in close touch, and the results of their work should be extremely helpful to the Gas Industry in the future.

Main's New Season's Gas Fire List

The new season list of Messrs. R. & A. Main is now out, and there is little doubt that it will greatly enhance the showroom manager's stock of literature. The greater portion of its fifty-six art paper pages are in colour, and the issue includes a sample folder of the colour finishes for Main gas fires.

Attention is directed to the "Duramain" gas fire radiants for which great strength and long service are claimed. The radiants are the outcome of a long period of experiment and research. Pride of place in the list is given to the "Author" series, which offers a choice of square or round top designs, suitable either for building in or for placing in front of existing coal grates. Duplex burners are provided in the larger sizes to enable the whole of the fire, or part only, to be used as required. Suitable boiling rings with special attachments can be supplied for these fires. Then follows the "Shakespearean" series which embraces models suitable for mantel recesses or tiled surrounds and is also available in round or square top designs, with or without dogs, for building-in, if desired. The "Cinderella" inset gas fire not only actually enhances the appearance of the fireplace, but the variety of available finishes will ensure complete harmony with any scheme of decoration. The "Gloria" fire, recently described in the "JOURNAL," offers distinct possibilities for the architect or builder in his decorative treatment of the fireplace.

Two panel type fires of distinctive design are the "Panamain" and "Starmain" from which the makers assure high heating efficiency. The "Crichton" has a minimum projection from the grate or panel to which it is fitted, and the extra height and curved shape of the radiants promote longer flame travel and a large radius of heat. It is claimed that this seven-radiant model is equivalent to a nine-radiant fire of standard design. The "Newscreen" and "Mainscreen," of modern and highly efficient design, are, as their names suggest, portable types. Bayonet type "plug-in" connectors for portable appliances are detailed in the list. The publication is concluded with descriptions of the firm's "Entente" inset gas fire which gives the appearance of a built-in fire, mantels and surrounds, panel heaters and radiators, the



The "Starmain."

"Main" heat generating unit, and a chart for gas fires and table of consumptions.

AN ANALYSIS OF MODERN VIEWS ON

Street Lighting

AND THEIR

Relation to Visibility

by

F. C. SMITH, F.C.S.

and

K. F. SAWYER, B.Sc.

(of the Gas Light and Coke Company)

Photograph 1.

From a Paper delivered at the Annual Meeting and Conference of the Association of Public Lighting Engineers in London on Sept. 11.

It will be agreed that the appraisement of a street lighting installation solely in terms of measurements made by stationary observers upon stationary test objects, may not represent the actual working conditions. Such measurements do not take into account the kinetic aspect and its effect upon the physiological and psychological response of the road users. Even if all the factors influencing the effectiveness of street lighting installations were known, assessed in relative importance, and were under control, the individuality of streets would still require a variety of technique in order to ensure optimum conditions.

For this reason it is futile to expect any street lighting specification to cover completely the many and varied conditions met with in practice, and it must remain with the public lighting engineer to combine the essentials of the specification with his knowledge of the practical requirements of the street in question.

The purpose of this Paper is:

(*a*) To enumerate the factors as far as they are known, which are of importance in promoting good visibility.
(*b*) To stimulate interest in the further study of the kinetic aspects of the problem.
(*c*) To review the British Standard Specification in the light of the more recent work and experience of lighting engineers.

Promotion of Visibility.

It is commonplace to say that the object of street lighting is to promote visibility, but in this simple statement is inherent one of the greatest difficulties of the problem.

Anyone connected with street lighting will understand in a general way what is meant by visibility, but the term has never been defined in an entirely satisfactory manner. It seems we mean that when visibility is good one can see objects with ease, but no one, as far as we are aware, has yet been able to propose a scale of numbers which can be determined by physical measurement, and which will assess the order of visibility in a given thoroughfare.

The absence of such a scale is a fundamental difficulty in appraising the true " revealing power " of a street lighting installation, and has compelled the adoption for specification purposes of measurable criteria, such as candle-power, illumination, or brightness.

Much of the criticism directed against the British Standard Specification for Street Lighting is due to failure to recognize this inherent difficulty. Lighting engineers have become so accustomed to such terms as foot-candles, &c., that there is danger of losing sight of the fact that these figures are but substitutes for something which, in our present state of knowledge, cannot be measured directly.

As is well known, the ability to see an object depends upon a contrast in brightness between the object viewed and its background, the smallest perceivable difference of brightness depending upon the absolute level of the field brightness. In favourable circumstances the smallest perceivable difference of brightness may be as low as 1·0% of the field brightness, but when glare is introduced in the field of vision this percentage increases rapidly. The cause of this decreased sensitivity is referred to as disability glare.

It is clear that the aim of a designer of an installation should be:

(1) To secure good contrast in brightness between the object to be seen and the background.
(2) To avoid loss in available contrast consequent upon disability glare.

For the sake of clarity, the term contrast in this Paper means the ratio of the brightness of the object viewed to the brightness of the appropriate background. It is convenient, therefore, to study in turn the conditions affecting the brightness of the object and that of the background.

Brightness of Object.

This is dependent upon the flux of light falling upon, and the reflection coefficient of the object. The former is under control in so far as the lighting engineer can arrange for practically any required distribution, and can provide the flux required, assuming no financial limitation, but he has no control of the reflection coefficient of the object he has to illuminate.

Brightness of Background.

It becomes important at this stage to study the constitution of the backgrounds, and it is here that the public lighting engineer is called upon to exercise considerable individual judgment.

Any or all of the following may constitute the background at any moment: (1) Road surface, pavement, or grass verge; (2) buildings, hoardings, fences, trees, &c.; (3) fields and similar open spaces; (4) sky; (5) other vehicles.

It must be recognized, however, that under practical conditions the background viewed is always changing, and, in consequence, the lighting of any given background without regard to the requirements of other equally important backgrounds, may prove disastrous.

There has grown up, in our opinion, a tendency to regard the road-surface as the all-important background, and, in consequence, to under-estimate the importance of others. In order to obtain data as to the relative importance of these backgrounds, a film camera, operated by a photographer sitting next to the driver in a saloon car, was employed. The driver was instructed to drive from Nine Elms Lane to Harrow. Both the driver and the operator were quite unaware of the object of the film, and the camera was operated for a few seconds every ten seconds along the route without regard to traffic conditions within the field of view. From a negative of this film a print was made of every twentieth frame.

From these photographs a careful analysis was made of the composition of the background, against which any object in the roadway must be seen. The background in every case consists, in whole or part, of: (1) The road-surface; (2) pavement, including kerb; (3) buildings border-

ing the road, and including trees (not necessarily lining the road), fences, and hoardings; (4) other vehicles; (5) the sky.

The outline of each object was divided into ten, and the number of tenths of this outline seen against each of the five components of the background, as detailed above, was computed. About 360 objects were so examined, and the average results are shown in Tables I. and II.

TABLE I.—*Table showing Relative Importance of the Road as Background.*

—	Total Number of Objects Considered.	Whole Outline of Object seen Entirely Against Road.	No Part Whatever of Outline of Object seen Against Road.	Outline seen Against All or Some of the Various Backgrounds Mentioned.
		%	%	%
Mechanically propelled vehicles	206	1·9	3·4	94·7
Carts, trucks, vans, &c.	53	*Nil*	7·5	92·5
Cyclists	51	*Nil*	7·9	92·1
Pedestrians (in road)	49	*Nil*	14·3	85·7

The last column of Table I. requires further analysis to show how the outline is distributed over the various backgrounds. This is carried out in Table II. hereunder.

TABLE II.—*Table showing Average Percentage of Outline of Object seen Against the Various Backgrounds.*

—	Road.	Pavement.	Buildings.	Other Vehicles.	Sky.
Mechanically propelled vehicles	33	8	41	12	6
Carts, trucks, vans, &c.	22	28	46	4	*Nil*
Cyclists	29	22	37	10	2
Pedestrians (in road)	33	13	34	20	*Nil*
Pedestrians (on kerb, about to enter roadway)	12	42	46	*Nil*	*Nil*

The control that can be exercised over the brightness of the viewed object has already been discussed; it remains to consider how far the brightness of the appropriate background is under control.

Road Surface.

The brightness of the carriage-way at any point is dependent upon three factors:

(1) Intensity of the light in a given direction.
(2) The material composing the surface and its condition at that point.
(3) The angles of incidence, reflection, and bearing subtended by the observer at the point.*

In regard to (1), this is entirely dependent upon the distribution of light and for practical purposes is completely under control.

In regard to (2), this is not primarily under control, although it is to be hoped that increasing recognition will be given to requirements of the illuminating engineer in this connection in the future, that is, assuming them to be consistent with economic and safety conditions. In point of fact, however, the lighting engineer must always be called upon to deal with many and varied types of surfaces. Moreover, the condition of any given surface is not constant, the weather, usage, and age all contribute to the uncertain condition of the surface. Variations in camber, gradient, &c., have also to be contended with.

As far as we are aware, no measurements have been published to show how the reflection factor will change with varying conditions of weather and usage, but it is common knowledge that the appearance of certain surfaces changes in a marked degree in wet weather, and this would indicate considerable changes in reflection values, possibly for certain surfaces of the order of 10 to 1. It is apparent, therefore, that the designer will be called upon to light surfaces which differ in a marked degree, and that reflection factors will change with new road dressings, usage, and weather conditions. Over these factors he will have little or no control.

Photograhp 1, which will be referred to again later in this Paper, is of interest in this connection. The left-hand side of this road has recently been re-dressed. The effect upon the reflection properties of the road is apparent.

Buildings, Hoardings, Fences, &c.

The designer, having surveyed the ground for the proposed installation, must then assess the importance to be attached to these backgrounds. In the case of a long straight road with buildings set back a considerable distance, these, in the writers' opinion, are of secondary account, but at bends and road junctions, they are often of paramount importance.

As is well known, much can be accomplished by the careful arrangement of sources (*i.e.*, on outside of bends, &c.),

Photograph 2.

and the distribution of the source can be modified so as to illuminate the appropriate surface. Frequently this may have to be done at the expense of test point illumination, in so far that it is desirable to allow the flux that would normally be redirected towards the test point to fall upon this background. It is unfortunate that some of these backgrounds, in practice, have low reflection factors, but much may be accomplished by co-operation with municipal engineers and the owners of bordering property.

Photograph 2 is of interest in this connection. The road in question is fairly well illuminated. Danger arises from the nature of the background at the bend of the road. Although it may not be apparent from the photograph, a car is standing at this point, and is almost entirely in-

Photograph 3.

visible—a typical illustration of danger arising from ill-considered lighting of appropriate backgrounds.

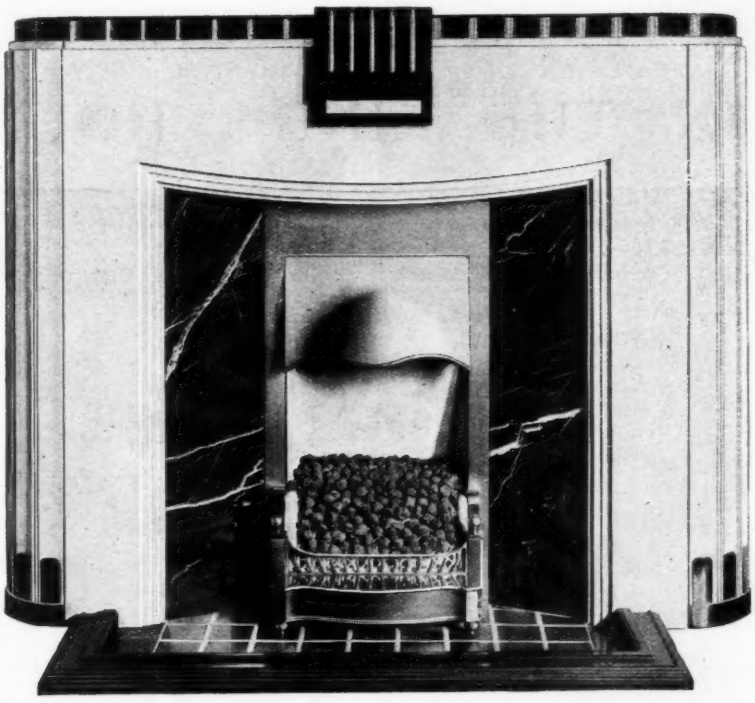
Photograph 3 is of the same place. A man can just be discerned leaning against the tramway pole. Actually the man is more visible in the photograph than he actually appeared to the observers, since glare from the nearest lamp reduced visibility for the observers, but was not registered by the camera. A piece of white paper was fixed against the fence, and the road re-photographed (see photograph 4).

The times of exposure, type of plates, time and temperature of development were the same for photographs 3 and 4. The improvement due to the whitening of the fence is apparent.

Fields.—The background here will in general be of very low reflection value and of such a nature that little use can be made of it. It would appear best under these con-

* See J. M. Waldran.—"Road Surface Reflection Characteristics and their Influence on Street Lighting Practice."

TALKS ON HEATING APPARATUS



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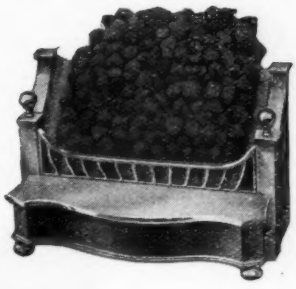

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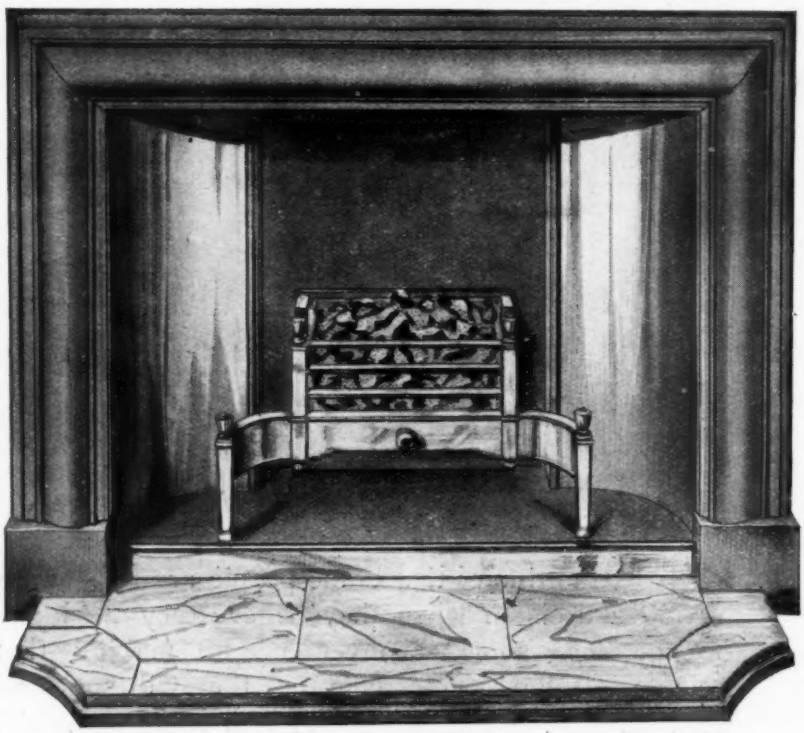

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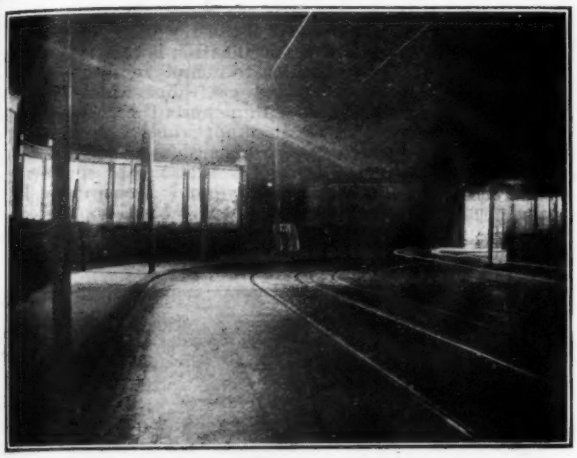
ditions to direct the whole of the available flux on to the road surface.

Sky.—This is frequently the background where roads are undulating, often becoming the sole background at the crest of a rise or bridge. Probably the most important consideration under these conditions is the avoidance of glare. Engineers may well adopt, under these circumstances, some special means of eliminating glare such as the provision of " cut offs," opal shades, &c.

Vehicles.—The importance of this background is obviously dependent upon the traffic density; where this is high, the mode of lighting will be greatly influenced by



Photograph 4.

this consideration. We have in this case to ensure contrast between vertical surfaces, and it seems reasonable to suppose that vertical illumination is the primary factor. Under these conditions a high flux and relatively close spacing are desirable.

Many factors intimately affecting contrast are not under the control of the public lighting engineer, and, indeed, do not remain constant. A rigid contrast requirement is impossible, but much may be done by giving attention to the various considerations raised in this discussion. A survey of the thoroughfare by a competent lighting engineer is

Photograph 5.

essential to a satisfactory installation; no installation can be completely planned on the drawing board.

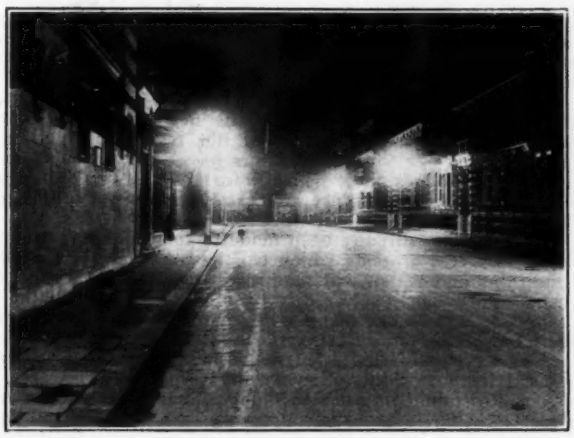
Kinetic Conditions.

Under practical conditions of street lighting the light stimulus received promotes a psychological response which finally results in some physiological action. It follows that factors which are subjective are of importance in street lighting practice.

Moreover, since moving objects are frequently to be observed by subjects not at rest the kinetic condition is of the utmost importance.

This is a sphere of work involving the psychologist, the physiologist and the illuminating engineer, and there can be little doubt that the safe lighting of our thoroughfares requires co-operation between workers in all three fields.

Little imagination is required to appreciate that psychology plays a not unimportant part in the lighting problem.



Photograph 6.

To make such a statement is simple, and the truth of the statement will be generally accepted, but difficulty arises immediately an attempt is made to formulate some method of test which will indicate to the street lighting engineer the correct technique to satisfy this trinity of requirements.

Much of the work carried out by the street lighting engineer has been under static conditions, and without wishing to appear critical of these efforts this fact alone, in the writers' opinion, may have led to incorrect deductions for lighting requirements.

Without desiring to labour the question of physiological response, and purely as illustrative, mention may be made of the deductions that are sometimes made as to the merits of a street lighting installation from photographs taken under static and uncontrolled conditions.

Photographs 5, 6, and 7 are of the same thoroughfare taken on plates from the same packet, developed and printed under precisely similar conditions. The ratio of the times of exposures were as follows:

Photograph No. 5 — exposure time 1.
Photograph No. 6 — exposure time 3.
Photograph No. 7 — exposure time 9.

Examination of photograph No. 5 will indicate that an object placed between the second and third lamp is almost invisible, whereas the object is clearly visible in photographs Nos. 6 and 7.

Moreover, the brightness of the road appears to be very good in the case of the negatives with prolonged exposure,

Photograph 7.

and very inferior in the other cases. In certain of these photographs the name on the facia is clearly visible, but in the evening this name was not visible to those in the street at the position of the camera, again mainly on account of glare.

Photographs do not give a correct impression of what is

seen unless they are taken under scientifically controlled conditions, since the chemical effect of light upon the emulsion is cumulative, whereas, once eye adaptation has occurred, no such cumulative effect is experienced by the eye.

Further, the data usually given by the illuminating engineer may fail to convey a true appreciation of the merits of the lighting of a street unless accompanied by some form of test which takes into account the physiological and psychological response of the subject under the actual conditions experienced in the street.

Photograph No. 8 is included, as it may be of interest. This print is faked by shading the negative during the printing process. The fake may not be obvious to the inexperienced eye, but the authors have seen photographs used in catalogues, &c., which were obviously faked in a similar manner. Engineers of standing will depreciate such practices.

Reference has already been made to the difficulty of outlining any test or tests which can be made under kinetic conditions and which will take into account the factors of response previously referred to.

One of the authors was privileged to discuss this matter with Dr. Halbertsma during the I.C.I. Congress at Berlin, and as a result of this discussion it was considered that a test carried out on the following lines might be of interest.

A route should be selected along which were a series of street lighting installations differing in character and intensity. Each installation should be of appreciable length, say, not less than 1 mile or, preferably, 1½ miles in length. A number of motorists should be requested to drive over the route in various types of vehicles. It is of importance that the drivers should be unaware that any tests were being made, so that abnormal conditions are not introduced. Each car to be fitted with a recording device to indicate the speed, &c., attained and maintained on any part of the route.

It is possible that an analysis of a very large number of these charts upon a statistical basis would indicate that the majority of the drivers found it necessary to reduce speed or take especial precautions at certain parts of the route. A very careful examination could be made of these interesting parts of the route, and a reason or reasons could be assigned for the additional care exercised.

It is easy to suggest a number of tests of a similar character which could be tried; for instance, records could be made of the conditions under which the majority of drivers found it expedient to use headlights over the prescribed route. If these, or similar, tests were carried out on a fairly ambitious scale, it is possible that information would be obtained that would reveal the weaknesses of the installations examined and enable broad principles to be established which, if applied, would be conducive to greater safety on the roads.

A similar set of experiments could be made by pedestrians so that their requirements under practical conditions were also considered. It is apparent that such experiments must be carried out under controlled conditions, and that the results would require interpreting by those skilled in statistical analysis.

B.S.I. Street Lighting Specification.

This specification has been subjected to searching criticism, and there can be little doubt that many amendments and revisions will be necessary before an entirely satisfactory specification is available.

It is well to remember, however, that a measure of agreement between all interested parties upon a basis of established good practice must always be secured before a British Standard Specification can be issued or amended; on the other hand, it is freely conceded that a specification lagging behind new developments is an encumbrance which is not to be tolerated.

Ignoring ignorant and ill-informed criticisms of the street lighting specification as unworthy of serious comment, it must be admitted freely that many whose opinions are entitled to the utmost respect feel, and feel very keenly, that the specification in its present form operates unfairly against new developments of undoubted interest and importance. On the other hand, there are others who do not share this view, and believe that all these new developments can find equitable expression within the present specification.

A street lighting installation is erected to promote safety for the motorist and pedestrian alike during hours of artificial lighting, and the safety of both these road users presupposes their ability to see with reasonable ease. The inherent difficulty in drafting a street lighting specification is that many of the factors affecting visibility in the streets are imperfectly understood and arising out of this, if not in consequence of it, no scale for visibility exists by which the visibility requirement for the installation can be specified.

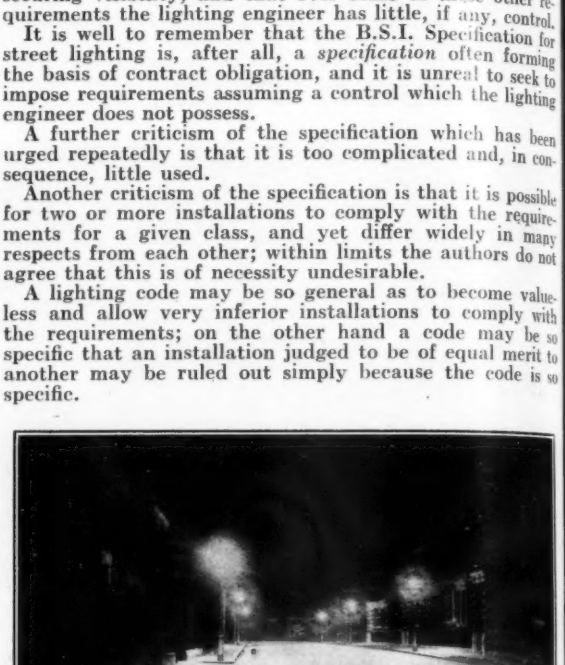
This fact, as has been pointed out before in this Paper, necessitates the adoption of criteria which in practice are likely to provide an index most in accordance with what practical experience dictates as desirable. There can be little doubt that factors other than light flux, distribution of flux, and arrangement of sources are of importance in securing visibility, and that over some of these other requirements the lighting engineer has little, if any, control.

It is well to remember that the B.S.I. Specification for street lighting is, after all, a *specification* often forming the basis of contract obligation, and it is unreal to seek to impose requirements assuming a control which the lighting engineer does not possess.

A further criticism of the specification which has been urged repeatedly is that it is too complicated and, in consequence, little used.

Another criticism of the specification is that it is possible for two or more installations to comply with the requirements for a given class, and yet differ widely in many respects from each other; within limits the authors do not agree that this is of necessity undesirable.

A lighting code may be so general as to become valueless and allow very inferior installations to comply with the requirements; on the other hand a code may be so specific that an installation judged to be of equal merit to another may be ruled out simply because the code is so specific.



Photograph 8.

We believe the B.S.I. Specification, while permitting of differing types of installation, satisfying the requirements, is in general sufficiently specific as to rule out installations which are obviously inferior as judged by present-day standards.

So much has been said in criticism of the B.S.I. Specification that there is danger of losing sight of its undoubted merits. It may be useful to state briefly the case for the specification as the authors see it.

(1) A review of the various national codes establishes beyond question that the B.S.I. Specification is the most complete and ambitious statement of the requirements for street lighting yet available. So far as the authors have been able to discover, no other national code has yet formed the basis of a specification of national standing.

It is possible that the criticism of complication arises out of the endeavour to make the specification thorough and sufficiently specific.

(2) The criterion adopted, which must not be divorced from the other equally important requirements to be referred to later, is that of minimum illumination on the highway. It is the function of the street lighting engineer to provide light and distribute it in a manner best suited to the requirements of the particular thoroughfare.

A minimum illumination requirement, coupled with a recommended height, and the limiting spacing height ratio permissible for the class does ensure that a minimum flux of light is available to illuminate the highway.

Importance of Reflected Flux.

It can be argued, and argued truly, that it is the flux reflected from the appropriate surfaces which is of importance. While it is agreed that the lighting engineer should co-operate in every possible way with the road engineer and others who may be concerned, it cannot be said that the control of the nature of the surfaces which have to be illuminated is with the lighting engineer.

Therefore, for the purpose of a specification, it appears to the authors that the lighting engineers' obligation must

end with providing the quantity of light required, and distributing the light in accordance with the requirements of the specification. Few will doubt that there is a real relationship between the quantity of light provided and the ease with which one sees, and in consequence, although it is freely admitted that other factors have an important bearing upon visibility, there appears to be good reason in adopting minimum horizontal illumination, coupled with the other requirements in the specification as a suitable criterion for specifying street lighting. In general the authors believe that the more light provided (if distributed and arranged to satisfy the requirements of the specification) the greater the visibility in the street, although it is true that in a small minority of cases this generalization is not completely satisfied. As far as we are aware, no one has suggested that surface brightness should be substituted in the specification for minimum illumination. If such a criterion were adopted, the latitude permissible under testing conditions would have to be considerably wider than that necessary for minimum illumination requirements; there would always be the necessity of determining whether a low brightness was due to a low value for the incident light, or a reduction in the reflection coefficient of the surface upon which the light was incident.

(3) The specification prescribes minimum mounting heights, maximum spacing height ratios, and Clause 17 (which deals with variations in rated illumination at test points) is drawn in a way calculated to discourage high diversity of illumination. It would appear, therefore, that the specification goes as far as agreement at the moment will permit to define the conditions tending to minimize glare effects. In addition, Clause 22 gives sound advice by suggesting glare can be minimized by decreasing the spacing and increasing the height of the light source. The authors are in favour of limiting the permissible candlepowers at angles near the horizontal, but this is not an agreed remedy, and, therefore, cannot be included in the specification until lighting engineers are agreed as to the efficacy of the principle.

(4) One of the most valuable aspects of the specification is undoubtedly to be found in the information to be provided with the tender. This requirement appears to the authors to take for granted that street lighting should be under the charge of a competent engineer, otherwise it is difficult to see what legitimate use can be made of the information to be supplied. The information in the hands of a competent engineer thoroughly familiar with the street to be lighted is of the utmost value.

In addition, the information to be supplied with the tender ensures that the engineer designing the installation shall be provided with all the necessary data.

(5) The specification is flexible enough to deal with difficult cases. To illustrate this point, Clause 16 may be referred to:

> "In other cases and where the symmetry of an installation is to be materially disturbed to make provision for lighting the entrance of side streets, or other reasons, the positions of any test points shall be those at which the illumination due to the light source under consideration would be a minimum, and *these positions shall be agreed* by the parties concerned."

(6) The specification provides for a testing clause, which can be applied to ascertain if the installation as designed has realized the design values, or may be used to ensure the installation is being reasonably maintained. It is impossible, in the authors' opinion, to over-stress the importance of good maintenance in street lighting installations.

In conclusion, we desire to thank the Governor and Court of Directors of the Gas Light and Coke Company for permission to publish this Paper, and for the facilities provided during its preparation.

Discussion.

Mr. PERCY GOOD (British Standards Institution) remarked that the view held by some people that the best conditions of visibility from the motorists' point of view were those in which there was no street lighting at all might be true in very isolated cases, but it was not true for the conditions which prevailed in city and suburban areas. He was glad the authors had joined issue with those critics of the standard specification who said that because visibility was necessary and the specification did not specify visibility directly, therefore it was a bad specification. The specification represented the collective views of a number of people after taking into account the many criticisms that had been made. Any specification of that kind must be in the nature of a compromise, and it must be regarded as a tool or implement for use by those competent to use it, and must

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not be regarded as, so to speak, the Ten Commandments. Moreover, the specification was not intended to stop progress, and it should not be allowed to; indeed, properly used it would not do that.

Mr. C. HARPER (Assistant Borough Engineer, Barking) said that for many years physics and optics had been compulsory subjects for the fully qualified municipal engineer, and having regard to what the President had said in his Address concerning the scientific aspect of the work of the lighting engineer this was a matter for consideration in the training of future municipal engineers.

Mr. E. L. DAMANT (General Electric Company, Ltd.) said he had often wondered whether the feeling that there should be a definite numerical assessment, as was provided in the standard specification, could not be made to fit in better with the other school of thought—of road brightness measurement—by using a small vertical test plate surface instead of a small horizontal one. It rather seemed that this would meet the case of direct illumination on a vertical surface—which Mr. Smith had said was improved in many cases—and it seemed to afford a closer relation to the resultant brightness on the road than did the illumination on a horizontal test plate. The result would still be foot-candles, and it would be a sort of compromise between the two schools of thought.

Dr. S. ENGLISH (London) remarked that it was a sign of the manner in which the Gas Industry was developing that it should have been possible for two such valuable Papers as those by Mr. Chandler and Mr. Smith to be presented to the Conference. Ten or 15 years ago it would have been absolutely impossible for the Gas Industry to have produced two such Papers at one Conference. At the same time he felt that Mr. Smith had mis-named his Paper and instead of calling it "Modern Views on Street Lighting and their Relation to Visibility" it would be better called "A Critical Examination of Some Modern Views on Street Lighting" because it was a most masterly examination of the subject. There was a tendency to speak of an increased candle power near the horizontal as an absolute essential for good road lighting. Personally, however, he felt that that was an over-statement of the case. In the case of long lengths of arterial roads with gentle curves with a great deal of vehicular traffic and very little pedestrian traffic, by all means have the maximum just below the horizontal and endeavour to obtain the so-called high surface brightness, but in urban and suburban areas where there was much more pedestrian traffic and twisty roads, it would be fallacious to try to light these roads in the same way that an arterial road was lighted. The ideal in this case was the maximum candle power distinctly lower than the horizontal. If roads were divided into two categories in this way there would not be much difference between the so-called protagonists of modern ideas and the protagonists of ideas which had been in use for many years.

Surface Brightness.

Mr. D. G. SANDEMAN (Edinburgh) did not agree with Mr. Smith when he said that nobody had suggested or ought to suggest that surface brightness ought to be made a criterion of a specification. Personally he thought it ought to be, and it could easily be done, because when they considered the different classes of roads such as had been seen during the tour of the lights of London it was seen what differences there were. He suggested that a standard surface should be laid down at Teddington, for example, in a shed 300 or 400 yards long where lighting fittings could be sent from the factory and tested first with regard to position and secondly with regard to surface brightness. If these two conditions were specified then it was only necessary to specify glare, which could be done quite simply because glare was inversely proportional to the height of mounting. That could easily be included in the specification. The point, however, was how it could be done. Personally he felt it was up to the members to make suggestions quite apart from the Committee, because nothing would be done with a large Committee.

Mr. G. H. WILSON (Research Laboratories, General Electric Company, Ltd.) said the Paper was a statesmanlike summary of the factors involved in street lighting and was the kind of fair and well reasoned statement they had grown to expect from Mr. Smith and his colleagues. On the question of backgrounds, he agreed that the street surface seen was not the all-important background, but he would try to make a case why the information on street surface brightness would generally give a very good idea of the performance of the installation. In his experience in a well planned installation, if other things were equal and the road brightness was high and reasonably uniform, with modern lighting units which tended to concentrate the light on the street surface, the other backgrounds mentioned in the Paper would, generally speaking, be adequately bright.

He was glad Mr. Smith had referred to the fact that, although 30% of the object was seen against the street surface, that 30% might be more valuable than the figure would suggest because the street was very much brighter than some of the other backgrounds. That was definitely borne out by experience of street lighting installations.

Speaking of taking street lighting photographs which could safely be used for comparative purposes, Mr. Wilson said he and his colleagues had worked out a simple technique for producing street lighting photographs which would really give the same impression on paper or on a slide as was obtained from the actual installation.

Mr. J. S. DOW (Hon. Secretary) remarked that the authors had dealt mainly with the advantages of contrast in revealing objects either on the roadway or backgrounds elsewhere. Lighting engineers were inclined to assume that if they got the light on the road and obtained a thoroughly bright surface, they had done the best that was possible, but was it not conceivable that with artificial illuminants the brightness could be so high as to act as a positive menace in the form of glare? For instance, with full sunlight on a polished roadway there could be a degree of brightness which was painful to look at. He had received a letter from a public lighting engineer in Holland some time ago who asked with regard to our experience in this country with central suspension because the difficulty in Holland was that with centrally suspended powerful lights, the lighting was excellent under dry conditions, but when the night was wet and the roadway thoroughly slippery there was that condition of a very brilliant line down the centre of the roadway, which resulted not only in insufficient visibility but the brightness was sufficient to cause appreciable glare. For that reason this engineer held the view that central suspension was injudicious in certain circumstances.

A second point was that, assuming a uniform surface was being aimed at, was it necessary to have the lamps high up and to have the light slightly below the horizontal, which inevitably caused some degree of glare? He was inclined to think that there would be some advantage on an arterial road by getting away altogether from existing methods and fitting lamps, as the late Mr. Hadyn Harrison once attempted to do, only 3 ft. or 4 ft. above the road with opaque reflectors at frequent intervals, set at various angles. In that way it might be possible to produce satisfactory conditions on the road and yet prevent anything in the shape of glare in the eyes of the driver.

Methods of Measurement.

Mr. J. H. BURMAN (North Middlesex Gas Company), regarding the standard specification, in this connection, said that the illumination should be measured on a horizontal plane and a speaker from the General Electric Company had stated he did not agree with that and thought it should be measured on a vertical plane. For years he himself had had a different opinion about that altogether. His idea was that light coming from two sources hit the object and was reflected from it; it then hit other objects and was reflected again and on the principle of the integrating sphere it was reflected in all directions. Therefore it seemed to him the better way would be to measure light on a sphere. At the moment he did not know of any photometer which would so measure light, but it should not be difficult to evolve such an instrument on the principle of the photo-electric cell. Instead of a flat surface it would have a spherical one on a little pillar something like a Belisha beacon and the light could be measured at any spot without having to bother about the cosine law. That should simplify matters considerably, and he expressed the hope that the Council might think it worth while doing something in this direction.

Mr. J. M. WALDRAN (Research Laboratories, General Electric Company, Ltd.) said that it was possible to take the figures given in the Paper a little farther than the authors had done. The value of backgrounds was made up in two ways. The first was the amount of the object seen against the background, and the second was the amount of contrast that could be expected from it. By working along these lines it might be possible to arrive at a true order of merit in which to place backgrounds as useful revealers of objects on the road. If some of those working on these matters had concentrated on road surface it was not because they had forgotten the value of other things, but because they were even less easy to control than the road surface itself. In that connection he mentioned the road near Berlin which had been inspected during the visit there which was practically devoid of any background except the surface of the road itself. The visibility was excellent, and that was an instance of the value of road surface; but if there was a background which could be turned to good account, then that was something to be thankful for.

Mr. C. A. MASTERMAN (Gas Light and Coke Company) expressed the hope that it might be possible to look forward to the time when photographs dealing with street lighting might themselves be the subject of a British standard specification. His second point was to echo very strongly the authors' defence of the street lighting specification, if it could be called a defence. Some years ago he himself had been among the critics of the specification, but the more he read it—and incidentally he was called upon to try to improve it—the more his admiration for it grew. It was difficult to keep the specification reasonably simple. People said it was too complex and at the same time inadequate, but if that criticism was carried too far there would be nothing perhaps but some amateur specification, and those who had had some experience of such specifications would agree that that would not be an improvement on the specification as they knew it now. The result would be worse than the present position. He was among those who felt, continued Mr. Masterman, that, by over-concentration on brightness they were running the danger at the same time of suffering from glare, because the two were closely linked together. Moreover, the basis of the present specification should not be shifted on to something so uncertain as brightness. Undoubtedly the specification was not complete. It was primarily the basis of co-operation between the buyer and the seller, but he feared that abuses of the specification were growing up because it was being used not as a basis of co-operation but as a kind of bone thrown among the competitors, and naturally the bone came off very badly in the ensuing fight. Therefore he urged that the specification should be used as a basis of co-operation on the part of the buyers and the sellers in the interests of providing efficient street lighting.

Mr. E. STROUD (London) said that although no comment had

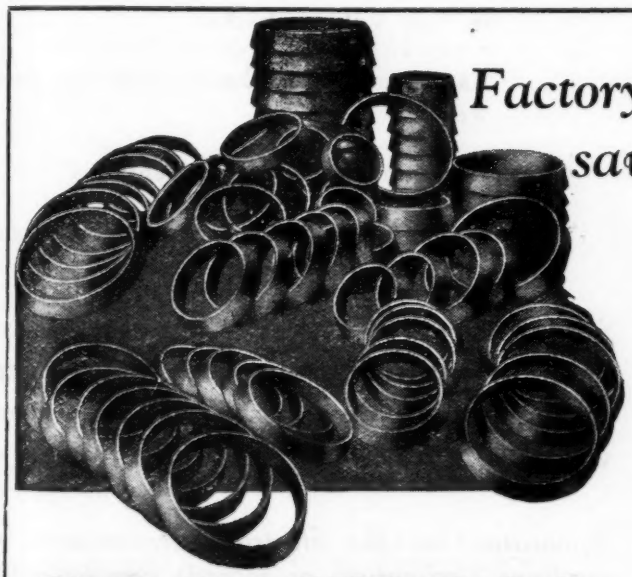
been made in the discussion concerning the very fine iso-lux diagrams in the Paper he believed they would serve an extremely useful purpose in quick design in what was becoming a very complicated business.

The Authors' Reply.

Mr. SMITH, replying to the discussion, agreed with Mr. Good in what he had said as to the specification being a tool or implement and not a complete text book. The fact remained that if a street was to be lighted adequately it was necessary to go into that street and study its characteristics, and then use the specification with a grain of commonsense. Then the information called for in the specification could be of the utmost value to a competent engineer. As regards measuring illumination on a vertical test plate, he did not think he was breaking any confidence in saying that a Committee of the B.S.I. had been considering some of the suggestions that had been made during the discussion, and that particular point had received consideration. It might be incorporated in the specification, but he could not say definitely. As to high candle power near the horizontal being an essential for good road lighting and the danger of that view, there were plenty of installations with high candle power components near the horizontal, but there were others which had not that charactertistic, and in his own view, in agreement with Dr. English, high candle power near the horizontal was not as essential to a good installation, and at times, although not always, might lead to undesirable glare. Dr. English had put his finger on the spot when he said, in effect, that special treatment was necessary for the different types of roads. For lighting long arterial roads there was more than one method available which would do this effectively. The road in Berlin which had been mentioned where there was not a high component near the horizontal. It was a fairly long straight road splendidly lighted, and he had seen other arterial roads where an alternative system had been used with excellent results. Personally, he preferred one method, and he would leave others to judge which that was, but generally it was desirable that more should be known about this matter. In the case of roads winding in and out, then it was essential to study each on its merits. As to the suggestion that there should be laid down at the National Physical Laboratory or elsewhere sections of roads, he felt that any such step would be doomed to failure from the point of view of being able to plan installations from the characteristics of these roads. It was urged and believed by some people that road brightness characteristics gave a better index of what was really seen when driving along an installation, and if, therefore, some standard surface was taken for planning an installation, that surface would probably not be representative of the actual road, and therefore any such steps would be doomed to failure. At the same time, the B.S.I. welcomed such suggestions, and would consider them. Glare was mentioned by Mr. Sandeman, but it was not so simple as being inversely proportional to the mounting height; he only wished it were.

While agreeing with Mr. Wilson that lighting engineers are able to design good installations to their own satisfaction, it did not follow that the members of a Council would consider these installations satisfactory. The views of the members of a Council might not be the same as those of the technicians, and therefore he said in all earnestness to Mr. Wilson that lighting engineers must not think they knew all about this subject. He agreed that many modern units which had a high component near the horizontal also had a very good general distribution. There were units in which that was taken care of, but if he mentioned the percentage of the flux necessary for bringing about the brightness of the road they would be surprised. He welcomed Mr. Wilson's remarks with regard to photographic technique. An important point had been raised by Mr. Dow when he suggested the possibility of an upper limit of contrast to be aimed at. Quite frankly it could be said that in practice the contrast required was not obtained, but he had seen installations in which Mr. Dow would be right in saying that the upper limit had been reached, but in most installations this was not a problem at the moment. As to alternative methods of producing road brightness he would prefer to say there were alternative methods of producing good visibility. The sphere method of testing, mentioned by Mr. Burman, had actually received some attention inasmuch as consideration had been given to the possibility of measuring illumination with vertical tubes—and he fancied that something like that was in Mr. Burman's mind. If Mr. Burman went any further with his idea the Committee would be glad to hear from him.

Undoubtedly, as Mr. Waldran had said, road brightness was important and desirable, but when it came to specifying it and making it the subject of a contract and obligation, then the problem began. It was not because those who were assisting to draft the specification thought brightness was of no importance that a clause was not in the specification, but because of the difficulty of drafting such a clause which could be equitably used in practice. There were so many snags about it with regard to change of surface that for the moment he did not see how it could be done.



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More easily handled than molten lead, a pre-cast lead ring also makes a more efficient lead joint. To assemble the Stanton Mechanical Lead Joint, a factory-made lead ring is pushed over the pipe spigot, and two half-collars are placed into position. The operation is then completed by the tightening of four cast-iron setscrews—no caulking is necessary.

Embodied in the lead ring is a steel spring insertion ring which distributes the pressure so that the joint is effective throughout the full depth. The ring is positively held in position and cannot shrink, loosen or be displaced by "drawing" of the spigot.

Patent No. 404955, other patents pending

STANTON MECHANICAL LEAD JOINT

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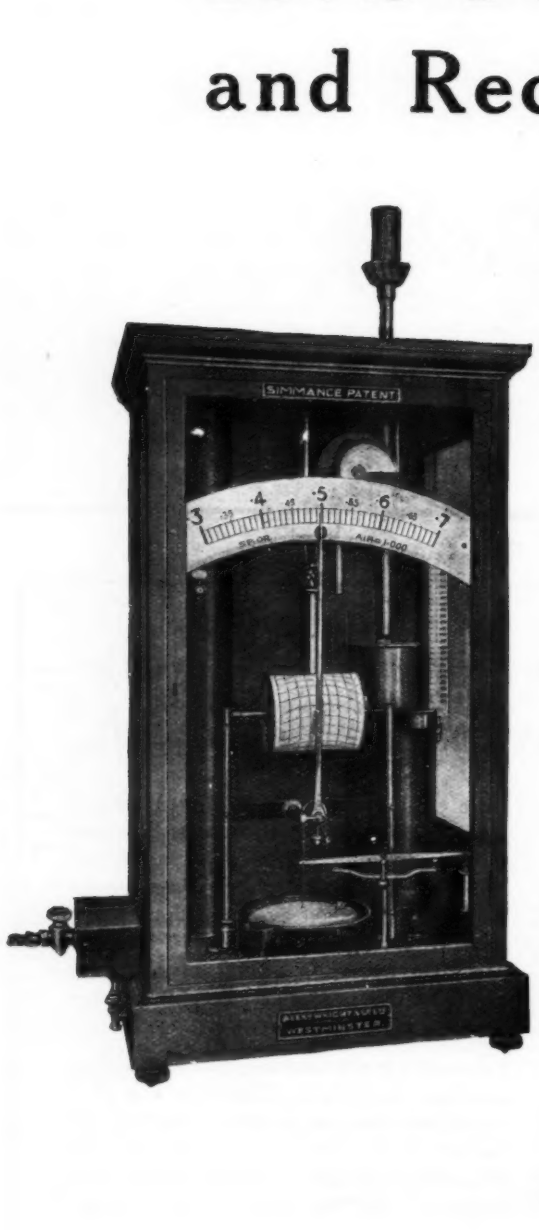

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It actually *weighs* the gas against a constant weight of air.

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Gas Markets and Manufactures

Stock Market Report

(For Stock and Share List, see later page)

A gloomy atmosphere prevailed in all markets last week, and prices suffered as a consequence. There was not a large amount of liquidation, but in the absence of buyers even the smallest sales were sufficient to bring down values. British Funds bore the brunt of the depression, which was accentuated in their case by rumours of a Government loan to be raised for defence purposes and prices dropped anything from 2 to 4 points. Despite the continuity of favourable reports, conditions in the Industrial market provided no exceptions to the general rule, and all the leading stocks were heavily marked down.

In sympathy with other sections the Gas Market was also depressed, and under the influence of the gilt-edged market some of the favourites fell in value. There was no general marking down, however, and compared with some departments the reactions were not of too serious a character. Gas Light units dropped 6d. to 27s.; Imperial Continental 4½ to 205, partly attributable to a widening of the margin; South Metropolitan 3 to 125½; and South Suburban 2 to 128½. On the other hand, the market was able to register a few gains. On the local Exchange, Newcastle units were in demand and the price rose 6d. to 26s. The Company's 3½% debenture also gained a fraction, while Alliance and Dublin 4% debenture was moved up 4 to 99½.

In pursuance of their policy of expansion, the Directors of the Sheffield Gas Company have made an offer for the acquisition of the Barnsley Gas Company. The provisional agreement provides for a cash payment of £160,000 by the Sheffield Company and *inter alia* the taking over by them of the vendor's issue of £30,000 5% debenture stock. With the purchase money it is proposed to redeem and discharge the Barnsley capital as follows: £190 for each £100 of general capital stock; £11 10s. for each £10 "C" preference share; £13 for each £10 "D" or "E" or "G" share, and £19 for each £10 "F" share. A special meeting of the Barnsley Company has been convened for Oct. 10, and if the proprietors agree to the proposals the transfer of the undertaking will take effect as from June 30 last.

The Directors of the Bombay Gas Company have declared an interim dividend on the £1 ordinary shares of 3½%, the same rate as a year ago, payable on Nov. 1.

Current Sales of Gas Products

The London Market for Tar Products.

Sept. 23.

There is little change to report in the tar products market, prices being about as follows:

Pitch, 33s. to 34s. per ton f.o.b.

Creosote, about 6d. per gallon.

Refined tar, 4d. per gallon in bulk at makers' works.

There is considerable demand for pure toluole, and the price is said to be not less than 2s. 3d. per gallon; pure benzole, 1s. 7d. to 1s. 8d.; 95/160 solvent naphtha, 1s. 5d.; and 90/160 pyridine, about 4s. 6d. to 4s. 9d.—all per gallon naked at makers' works.

Tar Products in the Provinces.

Sept. 23.

The average prices of gas-works products during the week were: Gas-works tar, 18s. to 28s. Pitch—East Coast, 31s. to 33s. f.o.b. West Coast—Manchester, Liverpool, Clyde, 31s. to 33s.* Toluole, naked, North, 1s. 8d. to 1s. 9d. Coal-tar crude naphtha, in bulk, North, 6¾d. to 7d. Solvent naphtha, naked, North, 1s. 5d. to 1s. 5½d. Heavy naphtha, North, 11d. to 11½d. Creosote, *ex* works, in bulk, North, liquid and salty, 5¼d. to 5½d.; low gravity, 5d. to 5⅛d.; Scotland, 5d. to 5¼d. Heavy oils, in bulk, North, 5d. to 5¼d. Carbolic acid, 60's, 1s. 11d. to 2s. Naphthalene, £11 to £13. Salts, 65s. to 75s., bags included. Anthracene, "A" quality, 2¼d. to 3d. per minimum 40%, purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *Sept.* 21.

While enquiries are numerous, actual business remains difficult. Prices show little or no alteration during the week.

Crude gas-works tar.—The actual value is 26s. to 28s. per ton *ex* works in bulk.

Pitch is comparatively inactive at 30s. per ton f.o.b. Glasgow for export, and 30s. per ton *ex* works in bulk for home trade.

Refined tar continues to be quoted at round 2⅞d. per gallon f.o.r. in buyers' packages, but new business is scarce.

Creosote oil.—Quotations remain steady but buyers are well covered. B.E.S.A. Specification, 5¼d. to 5⅜d. per gallon; low gravity, 5¼d. to 5½d. per gallon; and neutral oil, 5½d. to 5¾d. per gallon; all f.o.r. in bulk.

Cresylic acid shows a slight improvement, to-day's values in this district being as follows: Pale, 97/99%, 1s. 2d. to 1s. 3d. per gallon; dark, 97/99%, 1s. 0½d. to 1s. 1d. per gallon; and pale, 99/100%, 1s. 3d. to 1s. 4d. per gallon; all *ex* works naked.

Crude naphtha is still steady at 4½d. to 5d. per gallon f.o.r., according to quality and district.

Solvent naphtha.—90/160 grade is 1s. 3½d. to 1s. 4d. per gallon, and 90/190 heavy naphtha is 10d. to 11d. per gallon.

Motor benzole is well sold forward with value nominal at 1s. 3½d. to 1s. 4d. per gallon in bulk at makers' works.

Pyridines.—90/160 grade is 5s. 6d. to 6s. per gallon, and 90/140 grade 6s. to 6s. 6d. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s. d.		s. d.	
Crude benzole . . .	0 9½	to	0 10	per gallon at works
Motor ,, . . .	1 3	,,	1 3½	,, ,, ,,
90% ,, . . .	1 4	,,	1 4½	,, ,, ,,
Pure ,, . . .	1 7½	,,	1 8	,, ,, ,,

Trade Notes

The Gas Meter Co., Ltd., 238, Kingsland Road, London, E. 2, inform us that the Manchester Corporation Gas Department have adopted the "Recorda" Money Box to be used for collecting their weekly service charge, and the makers, The Gas Meter Co., have been favoured with instructions to supply the Corporation's requirements.

Contracts Advertised To-Day

Coal.

Dewsbury Gas Department. [p. 730.]

Gas Undertakings' Results

Deal and Walmer.

The accounts of the Deal and Walmer Gas Company for the year ended June 30, 1935, show that after paying in respect of the half-year to Dec. 31, 1934, dividends at the rate of: £6 10s.% per annum on the redeemable preference stock, and £7 15s.% per annum on the ordinary capital stock; and after paying all fixed charges, making provision for depreciation, and allocations to the renewal and benefit funds, there is a total available balance of £5,432, out of which the Directors recommend the payment (less income-tax) of the following dividends in respect of the half-year to June 30, 1935, at the rate of: £6 10s.% per annum on the redeemable preference stock, and £7 15s.% per annum on the ordinary capital stock, which together will absorb the sum of £3,687, leaving £1,745 to be carried forward to the credit of the current year.

Maryborough (New Zealand).

The half-yearly report of the Directors of the Maryborough Gas and Coke Company, Ltd., for the half-year ended June 30, 1935, states that the revenue from gas sales shows a decrease as compared with the corresponding period of 1934, which is principally accounted for by the substantial voluntary reductions in gas charges given by the Company to its consumers at the beginning of this year. Residual products also show a decrease due to the depletion of the previous large stock of tar on hand. Expenditure is practically the same as in 1934. The sum of £628 was transferred from reserve fund (under Gas Act) to the credit of profit and loss account to provide for part cost of new retort settings. After writing off £300 for depreciation, and making provision for all other charges, the profits amount to £805. To this amount has to be added £301, brought forward from last half-year, making the total amount at credit of profit and loss account £1,106. The Directors recommend payment of a dividend of 5% per annum, amounting to £1,031, leaving a balance to be carried forward of £75.

For increased efficiency in every process related to gas manufacture . . . .

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MODERN METHODS OF COAL & COKE HANDLING & TREATMENT

WEST'S GAS IMPROVEMENT COMPANY, LTD.

MANCHESTER : Albion Ironworks, Miles Platting. LONDON : Regent House, Kingsway, W.C.2

STOCK AND SHARE LIST

Official Quotations on the London and Provincial Stock Exchanges

Issue. £	Share	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations, Sept. 20.	Rise or Fall on Week.	Transactions, Lowest and Highest Prices During the Week.
1,551,868	Stk.	Sept. 9	7	7	Alliance & Dublin Ord. ...	130—140*	...	...
374,000	,,	June 24	4	4	Do. 4 p.c. Deb. ...	97—102	+4½	99—99¾
557,655	,,	Aug. 12	7	7	Barnet Ord. 7 p.c.	165—170	...	166
300,000	1	Apl. 8	1/4½	1/9½	Bombay, Ltd.	1⅞—1⅞	...	29/3—30/9
178,480	Stk.	Aug. 12	9½	9½	Bournemouth sliding scale ...	222—232	...	228
550,050	,,	,,	7	7	Do. 7 p.c. max. ...	168—173	...	173
489,160	,,	,,	6	6	Do. 6 p.c. Pref. ...	147—152	...	150—151½
50,000	,,	June 24	3	3	Do. 3 p.c. Deb. ...	85—90	...	...
262,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	106—111	...	...
335,000	,,	,,	5	5	Do. 5 p.c. Deb. ...	123—128	...	125
357,900	,,	Aug. 12	7½	7½	Brighton, &c., 6 p.c. Con. ...	170—175	...	...
649,955	,,	,,	6½	6½	Do. 5 p.c. Con. ...	156—161	...	...
205,500	,,	,,	6	6	Do. 6 p.c. B. Pref.	142—147	...	...
1,487,500	,,	July 8	5	5	Bristol, 5 p.c. max.	120—122*a*	...	...
120,420	,,	June 7	4	4	Do. 1st 4 p.c. Deb. ...	102—104*a*	...	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	101—103*a*	...	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	127—130*a*	...	...
855,000	,,	Mar. 11	7	8	British Ord.	154—159	...	...
100,000	,,	June 7	7	7	Do. 7 p.c. Pref.	160—165	...	...
350,000	,,	,,	5½	5½	Do. 5½ p.c. "B" Cum. Pref.	112—117	...	...
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...	...
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	109—114	...	...
200,000	,,	,,	...	17/6§	Do. 3½ p.c. Red. Deb. ...	99—101	...	...
100,000	10	22 May '33	6	4	Cape Town, Ltd.	1—3	...	...
100,000	10	6 Nov.'33	4½	4½	Do. 4½ p.c. Pref. ...	1—3	...	...
150,000	Stk.	June 24	4½	4½	Do. 4½ p.c. Deb. ...	83—88	...	...
626,860	,,	July 22	6	6	Cardiff Con. Ord.	127—132	...	...
237,860	,,	June 7	5	5	Do. 5 p.c. Red. Deb.	107—112	...	...
157,150	,,	Aug. 12	6½	5	Chester 5 p.c. Ord.	109—114*b*	...	...
98,936	1	Mar. 25	2/-	2/-	Colombo, Ltd., Ord.	1⅞—1⅞	...	...
24,500	1	,,	1/4½	1/4½	Do. 7 p.c. Pref. ...	20 6—22 6	...	...
609,204	1	Mar. 25	-/11·48	-/11·48	Colonial Gas Assn. Ltd. Ord.	20 6—22 6	...	...
296,053	1	,,	1/3·30	1/3·30	Do. 8 p.c. Pref.	25/—27/-	—1/-	25/-
1,775,005	Stk	Aug. 12	6	5	Commercial Ord.	100—105	...	102—104½
620,000	,,	June 7	3	3	Do. 3 p.c. Deb. ...	88—93	...	...
286,344	,,	Aug. 12	5	5	Do. 5 p.c. Deb. ...	121—126	...	...
807,560	,,	Aug. 12	7	7	Croydon sliding scale... ...	151—156	—1	...
369,590	,,	,,	5	5	Do. max. div.	113—118	...	...
620,385	,,	June 24	5	5	Do. 5 p.c. Deb.... ...	123—128	...	127—128
542,270	,,	Aug. 12	10	7	Derby Con.	180—190*c*	...	...
55,000	,,	June 24	4	4	Do. 4 p.c. Deb.	100—105*c*	...	...
239,000	,,	Aug. 12	5	5	East Hull Ord. 5 p.c.	109—112	...	...
181,625	,,	Aug. 12	6	6	East Surrey Ord 5 p.c. ...	129—134	...	...
175,609	,,	June 7	5	5	Do. 5 p.c. Deb. ...	123—128	...	...
19,313,481	,,	Aug. 12	5⅜	5⅜	Gas Light & Coke 4 p.c. Ord.	26/6—27/6*f*	—/6	26/6—27/4½
2,400,000	,,	,,	3½	3½	Do. 3½ p.c. max.	89—92	...	90—91½
4,477,104	,,	,,	4	4	Do. 4 p.c. Con. Pref. ...	106—109	—2	106½—109
8,602,497	,,	June 7	3	3	Do. 3 p.c. Con. Deb. ...	88—91	—3	89⅝—93
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	115—118	...	...
3,500,000	,,	,,	4½	4½	Do. 4½ p.c. Red. Deb. ...	113—116	...	114—116
270,466	,,	Aug. 12	6	6	Harrogate New Cons. ...	132—137	...	135
140,000	1	Mar. 25	1/7½	1/7½	Hongkong & China, Ltd. ...	1¼—1¼	...	...
213,200	Stk.	Aug. 12	6	6	Hornsey Con. 3½ p.c.... ...	130—135	...	...
5,600,000	,,	May 13	10	14	Imperial Continental Cap. ...	200—210	—4½	205—212
223,130	,,	July 22	3½	3½	Do. 3½ p.c. Red. Debs.	91—96	...	...
285,242	,,	Aug. 12	8½	8½	Lea Bridge 5 p.c. Ord. ...	175—180	...	...
2,167,410	,,	Aug. 12	6	6	Liverpool 5 p.c. Ord.... ...	134—136*b*	...	...
245,500	,,	June 7	5	5	Do. 5 p.c. Red. Pref. ...	105—110*b*	...	...
306,083	,,	July 8	4	4	Do. 4 p.c. Deb.	103—106*b*	...	...
165,736	,,	Aug. 26	10	8	Maidstone 5 p.c. Cap. ...	187—192	...	...
63,480	,,	June 24	3	3	Do. 3 p.c. Deb. ...	82—87	...	...
75,080	,,	May 27	†10	†10	Malta & Mediterranean ...	212—222	...	...
392,000	—	Apl. 1	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	100—105	...	...
231,978	Stk.	Aug. 12	5	5	M. S. Utility "C" Cons. ...	108—113	...	...
818,657	,,	,,	4	4	Do. 4 p.c. Cons. Pref.	101—106	...	103—104
360,075	,,	June 24	4	4	Do. 4 p.c. Deb. ...	103—108	...	105
148,955	,,	,,	5	†5	Do. 5 p.c. Deb. ...	123—128	...	...
125,000	—	July 1	3½	3½	Do. 3½ p.c. Rd. Rg. Bds.	97—100	...	...
675,000	,,	June 24	†13	†13	Montevideo, Ltd.	48—53	...	...
2,061,315	,,	Aug. 12	5½	5	Newcastle & Gateshead Con.	25/9—26/3*df*	+/6	...
682,856	,,	,,	4	4	Do. 4 p.c. Pref. ...	107—108*d**	...	...
776,706	,,	June 7	3½	3½	Do. 3½ p.c. Deb. ...	100½—101½*d*	+½	...
277,285	,,	Oct. 8	5	5	Do. 5 p.c. Deb. '43 ...	105—107*d*	...	...
274,000	,,	Aug. 12	5	5	Newport (Mon.) 5 p.c. max....	113—118*a*	...	...
225,000	,,	Aug. 12	7½	7½	North Middlesex 6 p.c. Con.	162—172	...	...
396,160	,,	Aug. 12	5	5	Northampton 5 p.c. max. ...	105—110	...	...
300,000	,,	Apl. 29	†9	†7	Oriental, Ltd.	168—173	...	...
416,617	,,	June 7	8	8	Plym'th & Stonehouse 5 p.c.	162—167	...	...
504,416	,,	Aug 12	8½	8½	Portsm'th Con. Stk. 4 p.c. Std.	170—175	...	...
241,446	,,	,,	5	5	Do. 5 p.c. max. ...	108—113	...	...
114,000	,,	July 22	5	5	Preston 5 p.c. Pref.	106—111	...	...
321,961	1	Apl. 8	...	...	Severn Val. Gas Cor. Ld. Ord.	22/—23/-	...	...
319,510	1	Mar. 25	...	...	... 4½ p.c. Cum. Pref.	22/—23/-	...	...
1,736,968	Stk.	Aug. 26	6	6	Sheffield Cons.	140—142*e*	...	...
95,000	,,	June 24	4	4	Do. 4 p.c. Deb.	102—104*e*	...	...
133,201	,,	Aug. 12	5	8½	Shrewsbury 5 p.c. Ord. ...	145—150	...	...
90,000	10	May 27	‡3	‡3½	South African	3—4	...	...
1,061,779	1	May 13	1/2½	1/2½	South East'n Gas Cn. Ld. Ord.	28/—29/-	...	28/7½—29/-
845,016	1	Mar. 11	-/10½	-/10½	Do. 4½ p.c. Red. Cum. Pref.	22/6—23/6	...	23/6
450,000	Stk.	Aug. 12	4	4	Do. 4 p.c. Red. Deb. ...	100—103	...	...
6,709,895	,,	Aug. 12	6½	5	South Met. Ord.	124—127	—3	123—127½
1,135,812	,,	,,	6	6	Do. 6 p.c. Irrsd. Pf. ...	147—152	...	148—149½
850,000	,,	,,	4	4	Do. 4 p.c. Irred. Pf. ...	107—110	...	...
1,895,445	,,	June 24	3	3	Do. 3 p.c. Deb. ...	89—92	...	90—92
1,000,000	,,	July 8	5	5	Do. 5 p.c. Red. Deb....	114—117	...	115½
209,820	,,	Aug. 12	8½	8½	South Shields Con.	171—173*d*	...	...
1,543,795	,,	Aug. 12	6	6	South Suburban Ord 5 p.c. ...	126—131	—2	...
512,825	,,	,,	5	5	Do. 5 p.c. Pref. ...	121—126	...	...
500,000	,,	,,	4	4	Do. 4 p.c. Pref. ...	105—110	...	...
888,587	,,	June 7	5	5	Do. 5 p.c. Deb. ...	123—128	...	...
250,000	,,	,,	4	4	Do. 4 p.c. Deb. ...	105—110	...	...
647,740	,,	Aug. 12	5	5	Southampt'n Ord. 5 p.c. max.	115—120	...	116½
121,275	,,	June 7	4	4	Do. 4 p.c. Deb.	100—105	...	...
350,000	,,	Aug. 12	5½	5½	Swansea 5½ p.c. Red. Pref. ...	113—118	...	116
200,000	,,	June 7	6½	6½	Do. 6½ p.c. Red. Deb. ...	98—103	...	...
1,076,490	,,	Aug. 12	6⅔	6⅔	Tottenham and District Ord.	149—154	...	148½—151
409,835	,,	,,	5⅔	5⅔	Do. 5⅔ p.c. Pref. ...	130—135	...	...
62,235	,,	,,	5	5	Do. 5 p.c. Pref. ...	120—125	...	...
334,615	,,	June 7	4	4	Do. 4 p.c. Deb. ...	101—106	...	...
369,774	,,	Aug. 12	7	7	Uxbridge, &c., 5 p.c.	150—155	...	...
108,330	,,	,,	5	5	Do. 5 p.c. Pref. ...	118—123	...	...
1,326,700	,,	Aug. 12	7	7	Wandsworth Consolidated ...	156—161	...	159—160½
1,371,373	,,	,,	5	5	Do. 5 p.c. Pref. ...	122—127	...	124—125
1,317,964	,,	June 7	5	5	Do. 5 p.c. Deb. ...	125—130	...	...
338,300	,,	,,	4	4	Do. 4 p.c. Deb. ...	105—110	...	...
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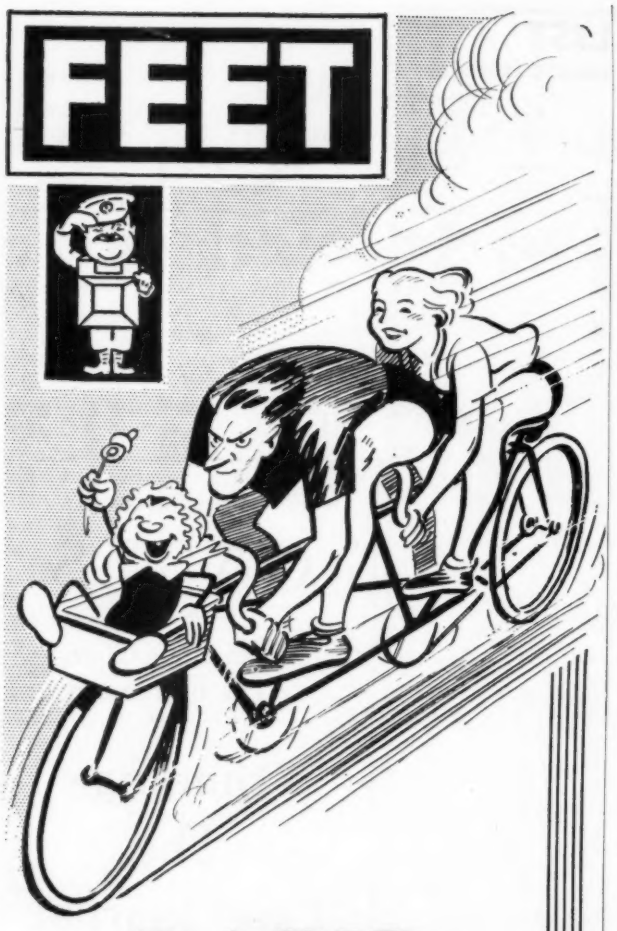

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